

Navy Medical newsletter



December 1969

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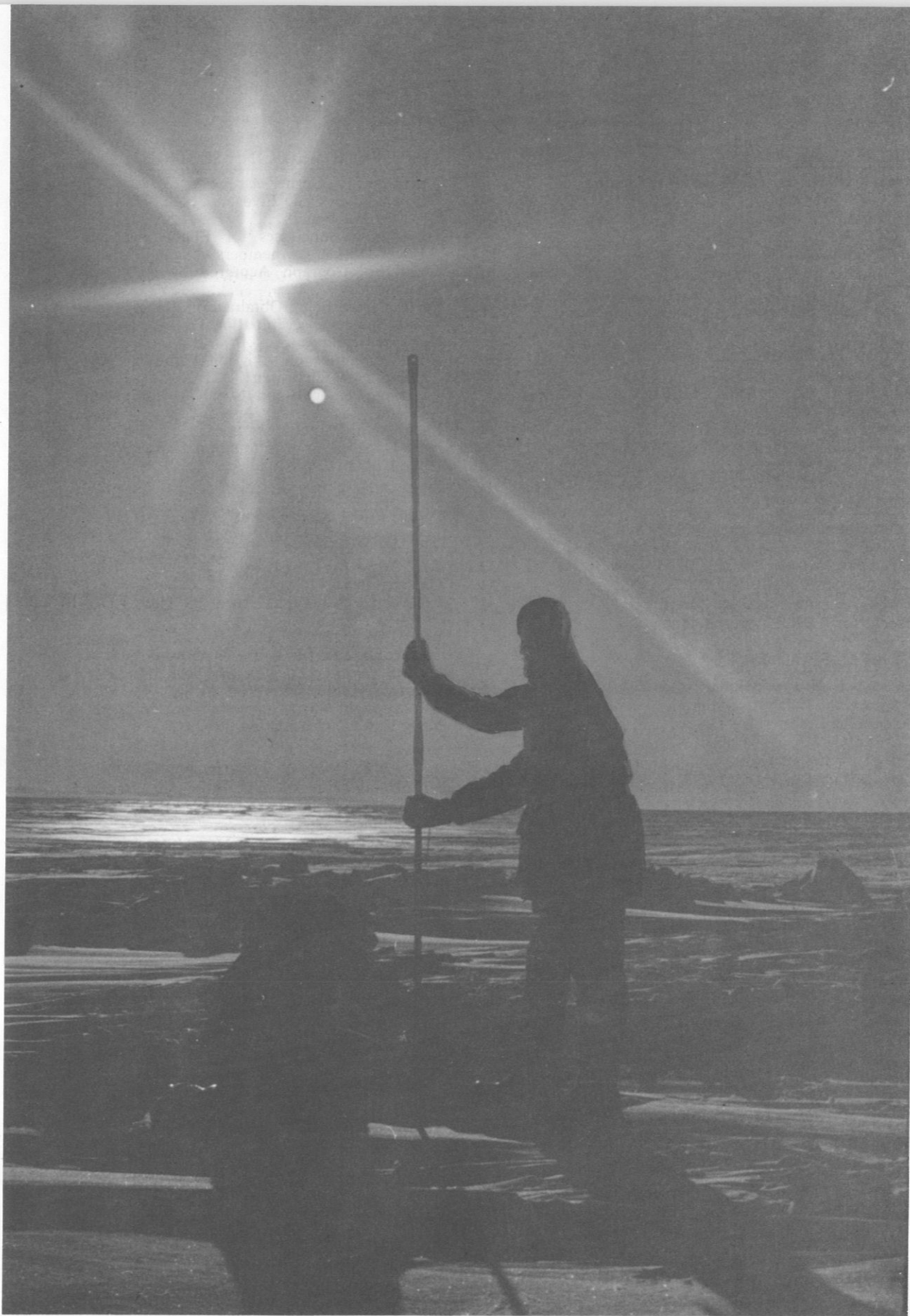
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Credits: We are indebted to CAPT John H. Stover, Jr., MC, USN for the cover photograph.
 Page 2. Moonlight silhouettes a member of the U.S. Antarctic Research Program (USARP) Team as he checks the depth of snow on the ice of Winter Quarters Bay near McMurdo Station. (Official U.S. Navy Photograph.)
 Page 51. Photograph contributed by CAPT Romaine M. Mentzer, NC, USN.
 All others are Official U.S. Navy Photographs.



Season's Greetings

It was a humble beginning on earth for The Infant Son with the mark of greatness upon Him. Something in the innocence and unexpected wonder of that legendary nativity scene has endured through centuries of time, reaching out to the heart of Mankind with universal and ageless appeal. It is the symbol of Christmas which conveys inspiration to the young, youth to the old, humility to the proud and hope to the oppressed. What profound and noble effect thus emanates from a simple pastoral scene! And this is fitting. For in the end, it is not by power and might that Man achieves his finest hours. It is the spirit of the people, that restless momentum of undulating force which surges forth in all its human imperfection to direct human destiny and alter the course of history.

So do our thoughts return to those who have sacrificed so much in answering the call to duty, to those who yet struggle in their own time and place, and to their loved ones who sustain them.

For some of you it has been a difficult year beset with obstacles and disappointments, yet not unrewarded I hope, by a keen sense of inner pride and satisfaction in what has been accomplished as a result of your effort, and by the expectation of what, together, we shall accomplish in the year ahead.

To each and all of you may the spirit of Christmas bring peace, renewed hope and the promise of fulfillment.



G. M. DAVIS
Vice Admiral, MC, USN
Surgeon General

RECENT ADVANCES IN FREEZE-PRESERVATION OF RED BLOOD CELLS

CDR C. Robert Valeri, MC USNR; LT Alan H. Runck, MSC USNR; and
CAPT Charles E. Brodine, MC USN. *JAMA* 208(3): 489-492, April 21, 1969.

The methods currently in clinical use for freezing human red blood cells (RBC) require the intracellular additive, glycerol, either in high concentration (approximately 45% W/V) with the slow freeze-thaw technique, or in low concentration (approximately 18% W/V) with the rapid freeze-thaw technique. The major technological problem in the current methods is the removal of the glycerol. Postthaw washing is presently accomplished by serial centrifugation ("batch washing"), continuous centrifugation, or a dilution procedure with recovery of RBC by agglomeration. Recent advances in the use of continuous centrifugation are extremely encouraging. However, for widespread clinical application of this approach disposable washing material is urgently needed.

The research and development effort of the US Navy Bureau of Medicine and Surgery in the freeze-preservation of human red blood cells (RBC) has been directed at fulfilling the need for a safe and efficacious biologic product to supplement the present liquid preservative program. Even with the extension of the shelf life of acid citrate dextrose-treated ACD blood to 35 days by adenine supplementation, the ability to store frozen RBC at -85°C for at least six years would help to equalize the supply and demand for RBC.

During the past ten years there have been a number of important advances in the preservation of human RBC by freezing. A variety of freezing techniques have been employed; they differ in regard to cryoprotective additives, freezing and thawing rates, temperature of storage, and postthaw processing. This communication presents methods for freezing RBC that are currently under investigation. The comments are oriented primarily to the safety and efficacy of the biologic product produced by each method, and the applicability of each method to both civilian and military use.

From the Naval Blood Research Laboratory, Chelsea, Mass (Dr. Valeri and Mr. Runck) and the Naval Medical Research Institute, Bethesda, Md (Dr. Brodine).

Read before the Section on Military Medicine during the 117th annual convention of the American Medical Association, San Francisco, June 17, 1968.

The opinions and assertions contained herein are those of the authors, and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

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The present systems for freeze-preservation of RBC, and in particular the recent advances in washing glycerolized RBC, are no longer experimental but are now in the developmental stage.

General Characteristics of Current Methods

The methods currently in clinical use for freezing human RBC require the intracellular additive, glycerol, either in high concentration (approximately 45% W/V) with the slow freeze-thaw technique, or in low concentration (approximately 18% W/V) with the rapid freeze-thaw technique. Postthaw washing is necessary to reduce the intracellular glycerol in order to prevent hemolysis of the preserved RBC after transfusion.

The present freezing techniques require special equipment for (1) the glycerolization phase; ie, the addition of the glycerol to the RBC prior to freezing; (2) the storage phase, whether at -85°C in mechanical refrigerators or in the gas phase of liquid nitrogen; and (3) the deglycerolization phase; ie, the removal of the glycerol prior to the transfusion.

For each method of freeze-preservation proposed, information is required regarding the prefreeze treatment, ie, anticoagulant used and length of storage at 4°C prior to freezing, the length of storage in the frozen state, and the length of postthaw storage at 4°C prior to transfusion.

Postthaw Processing.—The major technological problem in the current methods is the removal of the glycerol. Postthaw washing is presently accomplished by (1) serial centrifugation (batch washing), (2) continuous centrifugation, and (3) a dilutional procedure with recovery of RBC by agglomeration.

Batch washing of glycerolized RBC (18% W/V) commences with dilution with hypertonic sodium chloride solution. The diluted RBC are then separated from the supernatant by centrifugation and the supernatant fluid is removed. The RBC are then washed twice with isotonic sodium chloride solution. The preparation of the thawed RBC for use requires almost 1 liter of wash solution, approximately $2\frac{1}{2}$ hours, and a great amount of technician time. Batch washing would be very time-consuming for large-scale clinical use.

Glycerolized RBC (both 18% and 45% W/V) can be washed with a type of continuous centrifuga-

tion. The thawed glycerolized RBC are transferred to a spinning bowl and the RBC are washed continuously by exposure to a gradient hypertonic wash of electrolyte solutions followed by a final wash with an isotonic electrolyte solution. The concentration of the thawed glycerolized RBC transferred into the spinning bowl, the density and tonicity of the solutions, the spindle speed of the bowl, and the flow rates are factors that determine the volume of wash solution and the time required to reduce the final intracellular glycerol concentration to less than 1% and to lower the supernatant hemoglobin concentration to an acceptable level.

The spontaneous agglomeration of RBC that occurs in low ionic medium was utilized by Huggins to wash glycerolized RBC (approximately 45% W/V). In his procedure serial washing is achieved by dilution with low ionic wash solution and recovery of the RBC after the spontaneous agglomeration. The nonelectrolyte solutions used for washing, and the volume and composition of the electrolyte solutions used for subsequent disaggregation of the agglomerated RBC are extremely critical for maintaining acceptable posttransfusion survival of the preserved RBC, because the exposure of RBC to a low ionic environment produces a significant loss of cellular potassium. The major objections to the Huggins technique are the large volume of wash solution necessary (6.7 liters), the time required for preparing the cells for transfusion (approximately 50 minutes), and the in vitro loss of approximately 25% during the procedure.

Recent observations by C. R. Valeri, MD, and A. H. Runck (unpublished data) have demonstrated that glycerolized RBC (approximately 5% W/V) can in fact be washed more rapidly than they could be with previously used methods. The dilution of glycerolized RBC (either approximately 18% or approximately 45% W/V) with hypertonic salt solutions to reduce the glycerol concentration to approximately 5% W/V prior to transfer into a continuously spinning bowl permits the rapid collection and washing of the cells. At present reusable stainless steel and polycarbonate bowls are used in this washing technique. However, neither the reusable stainless steel nor the polycarbonate bowl meets the criterion for an ideal practical and simple method for preservation. There is a great need for disposable material in washing glycerolized RBC (Tables 1 and 2).

At this time, disposable material for washing RBC is being developed by two major companies. The recently accumulated information on washing of gly-

TABLE 1.—Current Methods for Freeze-Preservation of RBC With High Concentration of Glycerol (Approximately 45% W/V) and Slow Freeze-Thaw Technique*

Apparatus for Washing	Reusable Bowls	Huggins Cytogglomerator
Freeze-thaw hemolysis in polyvinylchloride plastic	2%-5%	3%-5%
Washing loss	3%-10%	12%-20%
Total in vitro loss	5%-15%	15%-25%
Volume of wash	4.0 liters	6.7 liters
Thawing time	15 minutes	5 minutes
Washing time	35 minutes	30 minutes
Total time for preparation	50 minutes	50 minutes
Technician time	Minimal to Moderate	Moderate
Residual glycerol (gm/100 ml)	<1%	<1%
Reduction in cellular K ⁺	10%	30%
Total supernatant Hgb mg/unit	400 mg	400 mg
Length of storage at -85 C with at least 24-hr postthaw stability at 4 C	At least six years	Maximum of two years
24-hr ⁵¹ Cr survival of autologous RBC following storage at 4 C up to 24 hr	90%	80%
Index of therapeutic effectiveness (%) (in vitro recovery × in vivo survival)	75%	60%

* Data from Haynes et al, Tullis et al, Huggins, and Mollison et al.

TABLE 2.—Current Methods for Freeze-Preservation of RBC With Low Concentration of Glycerol (Approximately 18% W/V) and Rapid Freeze-Thaw Technique*

Apparatus for Washing	Serial Centrifugation ("Batch Wash")	Continuous Centrifugation Reusable Bowls
Freeze-thaw hemolysis in stainless steel container and Teflon bag	2%-5%	2%-5%
Washing loss	2%-5%	2%-5%
Total in vitro loss	4%-10%	4%-10%
Volume of wash	<1.0 liter	3.0 liters
Thawing time	3 minutes	3 minutes
Washing time	2½ hours	10 minutes
Total time for preparation	2½ hours	15 minutes
Technician time	Excessive	Minimal
Residual glycerol (gm/100 ml)	<1%	<1%
Reduction in cellular K ⁺	10%	10%
Total supernatant Hgb, mg/unit	400 mg	400 mg
Length of storage at -150 C with at least 24-hr postthaw stability at 4 C	At least one year	At least one year
24-hr ⁵¹ Cr survival of autologous RBC following storage at 4 C up to 24 hr	90%	90%
Index of therapeutic effectiveness (%) (in vitro recovery × in vivo survival)	80%	80%

* Data from Krijnen et al, Rowe et al, and Pert et al.

cerolized RBC suggests that when disposable material does become available, a biologic product derived from frozen RBC will be available which will fulfill the following criteria:

1. In vitro recovery of at least 90% of the RBC after thawing and washing.
2. In vivo survival of the recovered RBC comparable to that of one-week-old ACD cells.
3. In a unit of blood a total amount of supernatant hemoglobin of approximately 300 to 400 mg.
4. A preparation time of approximately 30 minutes—roughly equivalent to the time required for crossmatching.
5. A total volume of wash solution of 3 to 4 liters.

Preparation of this biologic product with disposable soft ware in a completely automated wash cycle would represent a practical system for widespread clinical use and would thus add flexibility to the present blood-banking system.

Long-Term Storage and Postthaw Shelf Life.—At the time of this writing, the duration of storage of blood in the frozen state must be guided by the anticipated length of postthaw storage at 4 C before transfusion. Recent studies demonstrate that thawed glycerolized RBC (Huggins Technique) stored at —85 C in a low ionic medium for two years, washed by dilution in low ionic solutions, and recovered by agglomeration can be stored prior to transfusion at 4 C for at least 24 hours with a minimum of 70% 24-hour posttransfusion survival. However, glycerolized RBC (Huggins method) stored for longer than two years and washed by the Huggins technique cannot be stored prior to transfusion at 4 C for 24 hours and still maintain acceptable posttransfusion survival. These glycerolized RBC stored for up to three years at —85 C and washed by the Huggins method can be kept for only two hours at 4 C prior to transfusion and still maintain acceptable posttransfusion survival.

The postthaw instability of glycerolized RBC (Huggins technique) following storage at —85 C for longer than two years may be related to the low ionic environment during storage at —85 C or the low ionic washing procedure necessary to remove the glycerol or both. Investigations are under way to determine the cause of this limitation in postthaw storage time with RBC preserved according to the Huggins method.

By contrast, glycerolized RBC prepared with the Cohn blood fractionator and stored in ionic solutions for up to six years at —85 C have acceptable postthaw stability at 4 C. These thawed, glycerolized RBC were washed in reusable stainless steel bowls and stored prior to transfusion for at least 24 hours with acceptable in vitro recovery of RBC (80% or greater), and acceptable in vivo survival (at least 70% 24-hour posttransfusion survival). The temper-

ature of storage for high concentration-glycerolized RBC at —85 C can be readily achieved without rigorous control by mechanical refrigeration or dry ice or both. However, with low concentration-glycerolized RBC (approximately 18% W/V) in the gas phase of liquid nitrogen the temperature must be rigidly controlled. The temperature of the gas phase of liquid nitrogen at which damage to the glycerolized RBC occurs as a function of long-term storage has not been established. Testing of low concentration-glycerolized RBC after one year of storage at —150 C has shown this biologic product to be clinically acceptable.

Further studies are needed to provide information concerning the effects of the following variables on the preserved RBC: the ionic composition of the environment for storage of frozen glycerolized RBC, the temperature and length of storage in the frozen state, the washing procedure used to remove the glycerol, the composition of the resuspension medium, and the length of storage at 4 C prior to transfusion.

Need for Frozen RBC.—The cost of frozen RBC is greater than that of liquid blood. The determination of an acceptable cost for frozen RBC should be made on the basis of the need for the product. Needs for frozen RBC that could justify the cost might arise in the following situations in civil practice: (1) the ever-present clinical requirements of rare types of blood, (2) autotransfusions for patients who will require blood transfusion during elective operations, particularly if they possess irregular antibodies, and (3) the establishment of a supply of selected RBC lacking the antigens to which recipients are commonly sensitized, and from which the transfusion requirements of these sensitized individuals could be met.

Clinical Use of Frozen RBC to Date.—The clinical use of frozen blood has been limited because of the difficulty in removing glycerol. No more than 4,000 units of frozen RBC preserved with a high concentration of glycerol and freeze storage at —85 C have been transfused following washing in a sterile, continuous centrifugation process. This washing apparatus is complicated and has been replaced by reusable stainless steel and polycarbonate bowls, both of which can be attached by a special drive chuck to a centrifuge spindle.

An estimated 10,000 units of frozen RBC processed by the Huggins procedure have been transfused in civil and military practice. This procedure uses a high concentration of glycerol and slow freeze storage at —85 C in low ionic medium, and washing

in the Huggins cytoglomerator, a dilutional procedure with recovery by agglomeration.

In January 1966 at the request of the Department of Defense, the US Navy Bureau of Medicine and Surgery initiated a feasibility study in Vietnam to evaluate a frozen RBC blood bank system as a means of increasing the capability and flexibility of the standard blood bank system in combat zones. Selected RBC (O cde/cde, K⁻, Fya⁻, and O Cde/CDe, K⁻, Fya⁻) were frozen by the Huggins technique. Initial observations in a combat zone, based on transfusions of over 3,000 units of frozen RBC to severely wounded servicemen, have demonstrated both clinical acceptability and technical feasibility of a frozen RBC blood bank system.

In addition, approximately 1,000 units of frozen RBC, preserved with a low concentration of glycerol and stored at approximately -150 C in the gas phase of liquid nitrogen, have been transfused following washing (principally carried out by serial centrifugation, ie, "batch washing"). This freezing approach was introduced by Pert et al and has been modified by Krijnen et al and Rowe et al. These investigators use different extracellular additives in combination with glycerol in different freezing containers: Pert recommends a sucrose-glycerol solution and a Teflon bag; Krijnen recommends a sorbitol-glycerol solution and a stainless steel container; and Rowe prefers a mannitol-glycerol solution and a stainless steel container.

Guidelines for Evaluating the Practical Results of Freeze-Preservation Techniques.—There has been some discussion about the expectation from frozen RBC. The National Research Council—National Academy of Science Committee on Blood and Transfusion Problems has suggested guidelines to evaluate the results of various freeze-preservation methods in the light of the realities of blood transfusions in civil and military medical practice that influence the acceptance of such a preparation.

The Committee divided the uses of frozen RBC into two major groups: (1) the limited requirements for blood transfusion in special circumstances—rare RBC, autologous transfusions, surgical procedures requiring large quantities of blood, and (2) the circumstances in which ACD blood is usually given.

In group 1 the operational efforts and cost comparisons with ACD blood were not considered relevant, since the frozen RBC preparation was a unique biological product that offered advantages over ordinary banked blood preparation in these special circumstances. In group 2 the operational effort and monetary costs were considered to be dependent on

whether the frozen RBC were to be used in large quantities as a substitute for ACD blood, or to supplement the supply of ACD blood under special circumstances. If the frozen RBC are to be used in place of ACD RBC, it is recommended that the preservative technique should not be technically very complex and should not involve prohibitive expense. The loss of RBC incidental to the procedures involved should not be excessive. If the preserved RBC are to be used to supplement the ACD blood under special circumstances, the comparative expenses would not be so important. In such circumstances, it is doubtful that monetary costs would be important if the preparations meet the medical need.

Apart from the considerations of operational effort and expense, if frozen RBC are to be used as a substitute for ACD blood on equal clinical terms, the frozen product should meet the following biological requirements:

1. Total losses of RBC 24 hours after transfusion should not be greater than those in the transfusion of ACD blood as specified by National Institute of Health regulations. In addition, the decline of the RBC population surviving the first 24 hours after transfusion should be similar to that of normal RBC.

2. Preserved blood should not contain any additive that is toxic in man, that is not rapidly excreted or metabolized, or that is likely to sensitize the patient by reason of an antigenic component.

3. The preserved cells should be stable at low temperatures for at least one year, as measured by standard RBC survival studies.

4. Immediately and for at least 72 hours after thawing, RBC that have been stored in the frozen state should possess, as a minimum, physiological and bacteriological attributes similar to those of 21-day-old ACD blood stored under regular blood bank conditions.

5. The immediate and long-term condition of the recipient's health should not be prejudiced by any untoward secondary effect from a single or large multiple transfusion of preserved blood.

6. If possible, RBC should be packaged so as to permit the use of the same container for collecting, freezing, storing, thawing, and transfusing. This is particularly important to ensure maintenance of donor identification. In any event, however, the container used during the transfusion should permit direct visual inspection of the blood.

The freeze-preservation techniques now available can provide preserved RBC for use in special circumstances (group 1 described above). They can

also provide a *limited* supply of preserved RBC to supplement the ACD blood in special circumstances (group 2 described above). Frozen RBC will be available for *widespread* clinical use to supplement the ACD blood program only when disposable material for washing RBC becomes available. The availability of frozen RBC that can be prepared simply within the time necessary for crossmatching will help to reduce the amount of liquid blood lost by out-dating.

The development of a practical method for the freeze-preservation of RBC should provide an impor-

tant stimulus to the development of component therapy, which will permit the collection, separation, and storage of a variety of blood components and their recombination as needed in specific clinical situations. This approach will permit the optimal use of blood and blood products. The studies discussed here, made in large part in response to needs created by military operations, will also improve treatment in many conditions encountered in civil practice.

(The references may be seen in the original article.)

ASYMPTOMATIC HEPATITIS IN ADULTS GIVEN Y-GLOBULIN FOR PROPHYLAXIS

CLINICAL AND LABORATORY FEATURES

Gerald T. Keusch, MD, Boston; LTC Ray A. Olsson, MC USA, Washington, DC,
and CPT Frank J. Troncale, MC USAR, Boston. *Arch Intern Med*
124(3):326-329, Sept 1969.

Histologically confirmed, clinically asymptomatic viral hepatitis was found by serial surveillance of the serum glutamic pyruvic transaminase (SGPT) levels in 4 of 478 US soldiers given prophylactic y-globulin in a hepatitis-endemic area of Thailand. This is an incidence of 15.4 cases/1,000 man-years at risk in this environment. Biopsy in 21 other subjects with an SGPT level of 50 or more units revealed nonspecific alterations in 8, fatty metamorphosis in 8, and normal liver in 5. Of the total of 25 subjects with biopsies, 80% had histologically abnormal findings. Those with biopsy-confirmed hepatitis had SGPT elevations for at least four weeks with a peak level of 500 or more units. Thus, correlation between histologic findings and magnitude and duration of SGPT abnormality was good.

Viral hepatitis is a frequent cause of morbidity in military personnel. The disease has been shown to occur more commonly in an anicteric and asymptomatic form rather than with jaundice and prolonged disability. The possible importance of anicteric hepatitis as a silent precursor of chronic liver disease has been suggested by a recent study in Taiwanese mili-

tary personnel in whom histologic abnormalities persisted, progressed, or developed into cirrhosis in a significant proportion of patients observed for a year or more. The prevalence of anicteric hepatitis in nationals and in the military in Korea and Taiwan, estimated according to the serum glutamic pyruvic transaminase (SGPT) levels or physical examination and confirmed by liver biopsy, is from 1% to 2%. Such patients with asymptomatic and undiagnosed anicteric hepatitis constitute a serious potential public health problem for both residents and visitors.

This investigation was undertaken to determine the incidence of hepatitis in an American military unit serving near Korat, Thailand, under peacetime field conditions. We also provide information about clinical and laboratory features of hepatitis in normal adults given prophylactic y-globulin.

Material and Methods

The subjects were 478 members of a US Army Engineer battalion engaged in road building through jungle terrain, who gave informed consent and participated voluntarily in the studies described. In accordance with the current US Army regulations, all had received commercial, pooled y-globulin from American donors in a dose of 0.05 ml/lb body weight, intramuscularly, just prior to arrival in Thailand and were given the same dose five months later. Although some men worked with cleaning solvents, these were standard, nonvolatile, US Army chemicals

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From the US Army Medical Component, SEATO Medical Research Laboratory, Bangkok, Thailand. Dr. Keusch is now at the New England Medical Center Hospitals, Boston; LTC Olsson is at the Walter Reed Army Institute of Research, Washington, DC; and CPT Troncale is at the New York Hospital.

This material has been reviewed by the Office of the Surgeon General, Department of the Army. This review does not imply any endorsement of the opinions advanced or any recommendation of products named.

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not known to be hepatotoxic. Immunizations, while frequent, were given with disposable equipment. Consumption of alcoholic beverages was very common in this group of adult men and most admitted to at least occasional close contact with the local environment, including food and ice consumption and sexual relations.

Serum glutamic pyruvic transaminase activity was employed as the screening test of liver function (Sigma Chemical Co. Technical Bulletin 505, [May] 1963). A level of 50 or more units was designated as abnormal. Determinations of SGPT were done ten days after arrival in Thailand and at three-week intervals thereafter. Blood was drawn immediately

after breakfast, before the beginning of the work day. Sera were separated, frozen in dry ice, and shipped to the laboratory where the biochemical tests were performed two to four days later. When an abnormal SGPT value was found, the individual was recalled within ten days for history, physical examination, and the following determinations: levels of SGPT, serum glutamic oxaloacetic transaminase (SGOT), and alkaline phosphatase (Sigma Chemical Co. Technical Bulletin 505 [May] and 104 [March] 1963), bilirubin, and thymol turbidity, sulfobromophthalein retention, total serum protein content, serum protein electrophoresis (Spinco Division, Beckman Instruments, Inc., Technical Bulletin

Initial and Peak Laboratory Values, All Subjects

Subject No.	Biopsy Diagnosis *	SGPT †		SGOT †		Alkaline Phosphatase †		Bilirubin, mg/100 cc		Thymol Turbidity, Thymol Units		Sulfobromophthalein Retention, %	
		Initial ‡	Peak	Initial	Peak	Initial	Peak	Initial	Peak	Initial	Peak	10 day §	Follow-up
1	Hepatitis	300	1,680	177	770	2.4	4.4	0.4	0.9	—	6.6	13.3	3.1
2	Hepatitis	770	800	370	370	—	3.1	1.0	1.7	—	12.2	—	0.4
3	Hepatitis	440	1,080	155	218	—	6.6	0.5	3.5	—	12.1	28.8	7.2
4	Hepatitis	83	500	104	219	2.1	5.8	0.4	1.6	—	9.8	9.8	3.3
5	NHA	63	490	82	214	1.8	2.8	0.9	1.3	5.6	11.3	5.6	—
6	NHA	124	170	21	97	—	2.3	0.6	0.9	—	4.9	0.3	3.7
7	NHA	50	63 ¶	36	53	—	3.8	—	1.4	—	12.1	3.0	4.6
8	NHA	50	59 ¶	50	50	2.4	2.4	0.4	0.9	—	5.0	9.4	5.3
9	NHA	74	74	—	24	—	1.6	—	0.5	—	2.9	2.3	—
10	NHA	71	71	102	102	—	2.8	0.8	0.8	—	6.8	0.8	—
11	NHA	65	65	78	78	—	2.0	0.4	0.4	5.6	5.6	5.1	—
12	NHA	74	74	83	83	2.4	2.8	0.7	0.7	11.0	11.7	1.2	—
13	Fat	77	77	94	105	—	1.9	—	0.6	—	6.7	—	—
14	Fat	52	58	43	60	—	3.1	0.6	0.9	—	8.6	—	1.9
15	Fat	52	63	37	63	—	2.2	0.5	0.9	—	9.2	10.8	—
16	Fat	58	63 ¶	39	39	—	2.1	0.5	0.8	—	14.8	2.7	—
17	Fat	63	65 ¶	30	31	—	2.8	0.2	0.8	—	15.3	—	—
18	Fat	55	55	67	67	0.7	1.4	0.9	0.9	3.1	5.2	6.4	—
19	Fat	50	50	39	39	—	1.8	—	1.4	—	6.9	—	—
20	Fat	61	61	27	28	—	2.1	0.9	0.9	—	4.1	—	—
21	Normal	52	52	87	87	1.3	1.8	0.9	0.9	6.2	6.2	—	—
22	Normal	77	77	78	78	2.2	2.6	0.6	0.8	3.8	3.8	2.7	—
23	Normal	58	58	29	29	—	2.3	0.7	0.7	—	4.6	—	—
24	Normal	200	200	130	130	8.6	8.6	0.6	0.7	4.1	22.8	3.3	—
25	Normal	63	63	102	102	2.0	2.0	1.5	1.5	4.1	4.2	1.9	—
26	—	58	58	70	70	1.3	1.7	0.5	0.9	7.0	7.0	3.5	—
27	—	63	63	65	65	—	3.3	—	—	—	—	—	—
28	—	50	50	39	39	—	2.4	—	—	—	—	—	—
29	—	67	67	202	202	—	—	—	—	—	—	—	—
30	—	52	52	82	82	1.1	1.5	0.5	0.5	3.5	3.9	3.9	—
31	—	60	60	—	29	—	1.9	—	0.5	—	5.2	1.9	—
32	—	58	58	46	46	1.1	1.7	0.7	0.7	3.5	8.5	3.5	—
33	—	50	50	—	47	—	3.1	—	0.5	—	3.6	2.3	—
34	—	55	55	50	50	1.3	1.5	0.3	0.3	4.0	6.8	4.7	—
35	—	52	52	83	83	—	—	—	—	—	—	—	—
36	—	113	113	—	20	—	1.9	—	0.8	—	1.7	—	—
Normal value		<50		<50		<2.3		<1.0		<5		<5	

* NHA indicates nonspecific hepatocellular abnormality.

† Expressed in Sigma-Frankel units.

‡ Values obtained at the time the first abnormal value was found for SGPT.

§ Values obtained after initial abnormal value was found for SGPT.

|| Three or more weeks later.

¶ Second transient elevation.

OIR-I, 6027A, 1960), heterophil agglutination, and *Leptospira* agglutinations with a battery of 18 live antigens. Subjects were hospitalized for medical evaluation, and if consent was obtained, liver biopsy was performed with a Menghini needle through an intercostal approach. Specimens were fixed in 10% buffered formalin, and stained with hematoxylin and eosin, PAS, and for iron and reticulin. Subjects were closely observed with studies being performed at frequent intervals until return to duty or medical evacuation from the theater.

All biopsies were reviewed by the same pathologist. Because he was aware that an elevated SGPT level was present in each subject studied, strictly blind evaluation of the biopsies was not possible. The pathological diagnosis of viral hepatitis required the presence of acidophilic bodies, portal mononuclear cell infiltration, and parenchymal cell necrosis. Biopsies considered abnormal but not exhibiting all of these changes were grouped together as indicating nonspecific alterations.

Results

Histological Diagnosis.—Of the 478 men who originally volunteered, 308 remained when the study was terminated eight months later. The number of participants decreased linearly during the study due to transfer to other units or return to the United States. Elevations of SGPT levels were found 58 times in 36 subjects. Liver biopsy was performed in 25 of these subjects and the diagnosis of viral hepatitis was made in four. An incidence of 15.4 cases/1,000 man-years at risk was calculated from these data. The biopsies were interpreted to show nonspecific alterations in eight subjects and fatty metamorphosis in eight, while normal liver tissue was present in five.

Biochemical Data.—Subjects were grouped according to histologic diagnoses which correlated well with the magnitude and duration of the SGPT abnormalities (Table). In the four with hepatitis, peak SGPT values ranged between 500 and 1,680 units, and an abnormal SGPT value persisted for at least four weeks. All four had elevations of alkaline phosphatase and SGOT levels. None had an early alteration of serum bilirubin value, but three subsequently had mild hyperbilirubinemia. After four, seven, and ten weeks of hospitalization, SGPT values returned to normal in three of the four men. The remaining subject was evacuated to another hospital

with a marked transaminase elevation of nine weeks duration.

The initial rise of SGPT level in subject 5 was 63 units and was normal at the end of the ten-day followup. Ten days after this, however, SGPT was found to be markedly elevated and subsequently remained abnormal for at least eight weeks when he was evacuated to another hospital. The diagnosis remains uncertain in this subject since the first biopsy revealed only nonspecific changes and a second biopsy attempt was unsuccessful. While the SGPT abnormality was similar to that in the four patients with biopsy-confirmed hepatitis this patient was included in the nonspecific alterations group.

A continuous moderate elevation of the SGPT level was found in subject 6. Liver biopsy was performed on five occasions and revealed only nonspecific alterations without progression. Findings at physical examination remained normal and he was entirely asymptomatic and continued to work without difficulty.

In four subjects (subjects 13, 14, 15, and 26) there was a mild elevation of SGPT activity (51 to 77 units) which persisted for at least ten days, associated with an abnormal SGOT level (60 to 105 units). Both enzymes were normal by day 21. Results of other liver function tests subsequently remained normal with the exception of the thymol turbidity test. Biopsies were performed in three and fatty metamorphosis was present in each. All four subjects admitted to generous alcohol intake and one was diabetic and taking tolbutamide.

A mild to moderate elevation of SGPT (50 to 200 units) could not be confirmed when repeated within ten days in 26 men (subjects 7 through 12, 16 through 25, and 27 through 36). (One subject was transferred just after study and two were absent at follow-up but their enzymes were normal at the next regular three-week check.) Four had similar transient elevations one or more times subsequently. Liver biopsy in 16 revealed the following: nonspecific alterations, 5; fatty metamorphosis, 5; nonspecific alterations and fat, 1; and normal histological findings, 5. Serologic evidence of infectious mononucleosis was present in subject 24.

For the first six months of the study, SGOT values were routinely determined along with SGPT. In 12 subjects, SGOT elevation (mean 64.9; range, 50 to 110) was found without SGPT elevation (mean, 24.3 units; range, 10 to 36). In all subjects, SGOT levels were normal three weeks later and SGPT values subsequently remained normal. Therefore biopsies were not performed on any of these subjects.

Except in the subject previously mentioned, findings from serial heterophil agglutination tests were nondiagnostic. *Leptospira* agglutination reaction was negative in all.

Clinical Features.—The absence of symptoms in the subjects with confirmed hepatitis was striking. Anorexia, malaise, headache, or abdominal pain were present individually as the sole symptom of the disease in each of the four patients. The symptoms were so mild, however, that none lost a day of work by reporting to sick call. Indeed, during the interval between the initial detection of an abnormal SGPT value and actual hospitalization which ranged from one to five weeks, these men continued hard physical work in spite of an SGPT level as high as 1,680 units. Distaste for cigarettes or gastrointestinal complaints other than anorexia were not encountered.

Hepatomegaly was found in two, and three had liver tenderness. These signs and the symptoms described here were also found in an equal number of subjects who did not have biopsy evidence of viral hepatitis.

Comment

This investigation differs from previous studies of the prevalence of viral hepatitis in a military group in that continued surveillance was maintained for eight months in a group of Americans who were living in a hepatitis-endemic area and who had been pretreated with pooled γ -globulin obtained from American donors. The incidence of hepatitis in the troops under study was 15.4 cases/1,000 man-years at risk. There are several sources of potential error in this figure. A man could have acquired the infection and left the unit before the infection was detected. Any subject in whom the duration of transaminase elevation was less than three weeks must have escaped detection. Last, some men were absent when blood was drawn and could have had hepatitis during the resulting six-week interval. We are not aware of any other factors which would cause an overestimate, so that the 15.4 cases/1,000 man-years at risk represents a minimum figure.

In each subject with hepatitis, the clinical course was so mild that, except for this study, none of these would have been diagnosed. This is remarkable in view of the marked elevation of transaminase level which occurred during the early phase of illness. The

patients with hepatitis could not be selected on the basis of clinical symptoms and signs. The best selection would have been obtained from physical examination for hepatomegaly or a tender liver. However, an equal number of subjects without hepatitis would thereby have been included. In this study, in four of five subjects with SGPT values greater than 200 units and abnormal values continuing for three weeks or more, biopsy-confirmed hepatitis was found and suspected in the fifth subject, so that liver biopsy might not have been necessary for diagnosis. Because the number of patients is small and such segregation of hepatitis by the SGPT values might not be found in a larger group, we do not mean to imply that liver biopsy is an unnecessary procedure in the diagnosis of viral hepatitis.

Liver biopsy was rewarding in subjects with an elevation of SGPT value greater than 50 units, even on a single occasion. Histological findings were abnormal in 69% (11 of 16) of the subjects with biopsies on the basis of this criterion. When SGPT elevation was confirmed by repeat test within ten days, either hepatitis or fatty metamorphosis was found. In all, 80% (20 of 25) of the biopsies were considered abnormal.

The clustering of instances of hepatitis in the fourth and fifth months of the study is interesting. While we do not have an explanation for this, a similar phenomenon was noted by Conrad in US troops in Korea. He attributed this to the establishment of close contacts with the local environment at this time. We do not have sufficient data to comment on this possibility and the epidemiological significance of this apparent clustering is not known.

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LTC John V. Morris, VC USA, performed the *Leptospira* agglutinations.

Generic and Trade Names of Drug

Tolbutamide—*Orinase*.

(The figures and references may be seen in the original article.)

PENETRATING WOUNDS OF THE NECK

A MILITARY AND CIVILIAN EXPERIENCE

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The ubiquitous nature of penetrating wounds of the neck has been emphasized in numerous previous studies. Few surgeons, civilian or military, personally see enough such injuries to become expert in their management. The problem is compounded by the apparent benignity of many such wounds upon initial examination, and the lethal nature of complications if the original care is inadequate. It seems profitable, therefore, to review a simultaneous military and civilian experience with 75 penetrating wounds of the neck, in order to record the principles in the early treatment of such potentially lethal injuries.

Clinical Experience

Military Experience.—Between July 1 and Dec. 1, 1968, 62 patients with penetrating injuries of the neck were admitted to the US Naval Support Activity Hospital in DaNang, Republic of Vietnam. All but four of these casualties were US marines wounded 30 to 90 minutes prior to being admitted by helicopter to this well-equipped and staffed hospital. Such casualties had received only first aid in the field prior to helicopter evacuation.

The war in Vietnam is characterized by a high incidence of injuries from booby traps and land mines. Approximately 50% of these injuries were from low velocity fragments. Characteristically, such wounds were accompanied by multiple fragment wounds elsewhere on the head and usually on the extremities. Since marines in combat usually wear an armored vest which is protective against low-velocity fragments, the thorax was characteristically spared.

High-velocity missiles (usually the Chinese AK-47 rifle) accounted for the vast majority of the remaining half of the injuries. Such injuries were usually single and were accompanied by extensive damage to surrounding structures.

Breakdown of the 62 military injuries and docu-

mentation of the cervical organs involved is as follows:

	Cases	Deaths
Soft tissue and minor blood vessels	25	0
Carotid artery	12	3
Innominate artery	2	1
Internal jugular vein	7	0
Thyroid, hyoid, cricoid, trachea, larynx and pharynx	16	0

Follow-up of these cases was understandably limited in a military hospital located in a very active war zone. These casualties were kept under observation prior to evacuation for 2 to 18 days. Since the severely injured or those in whom complications were highly suspect were delayed in evacuation, it is reasonable to assume that the majority of major life-threatening complications are recorded even in such a short postinjury observation period.

Soft Tissue Only.—In 25 cases only the skin, underlying soft tissue, and minor blood vessels were involved. There were no deaths among these patients. Armed with a high index of suspicion each of these wounds was debrided and its depth explored regardless of its apparent innocence. This requires professional self-discipline in patients who frequently had associated life-threatening injuries to the extremities, head, or abdomen, and in whom the cervical injuries occasionally appeared incidental.

Internal Jugular Vein.—There were seven casualties in whom the internal jugular vein was the only cervical structure of importance to be injured. In all but one patient the jugular vein was ligated. In the other, a tangential laceration of the internal jugular vein was oversewn. In addition, there were three casualties where there was injury both to the jugular vein and the accompanying carotid artery. In each the vein was ligated.

There were no deaths in any of these patients. Unrelated jugular vein ligation is obviously innocuous and the simplest means of management of such wounds.

Carotid Artery.—As documented in Table 1, there were 12 patients in which the carotid artery was the main cervical injury. Three of these patients had con-

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TABLE 1.—Carotid Artery Injuries (DaNang)

Case No.	Vessel	Lacerated or Severed	Repair	Occlusion Time (min)	Course	Associated Head and Neck Injuries	Associated Noncervical Injuries	Comments
1	Common	Lacerated	Suture	0	Died	Perforating head injury	—	Died of associated head injury
2	Common	Lacerated	Resect 5-cm saphenous vein	100	OK	—	—	—
3	Common	Severed	Resect 5-cm saphenous vein	55	OK	—	*MFW, extremities	—
4	Internal carotid	Severed	Anastomosis	70	OK	—	Lacerated eye	—
5	Common	Severed	3-cm Dacron graft	80	OK	—	MFW, extremities; lacerated femoral nerve	Temporary aphasia and weakness; cleared; ? occlusion of Dacron graft
6	Common	Lacerated	Anastomosis	90	Died 3 days	—	—	Postmortem; anomalous take-off vertebral artery distal to injury of carotid artery
7	Common	Lacerated	Anastomosis	65	OK	—	MFW, extremities and chest	—
8	Common	Lacerated	Anastomosis	60	Died 12 hr	Enucleation OD	Lacerated femoral artery; MFW, extremities, small bowel	Initial cervical wound innocuous looking; thoracotomy and massage prior to surgery
9	Common	Lacerated	Anastomosis	72	OK	Internal and external jugular vein; fractured mandible	—	Laceration at carotid bifurcation; external carotid ligated
10	Common	Lacerated	Anastomosis	60	OK	Interior jugular vein; thoracic duct	—	Subcutaneous emphysema; transverse incision; tracheostomy
11	Common	Lacerated	Anastomosis	21	OK	Vagus, interior jugular vein	—	Transverse incision
12	External carotid	Lacerated	Ligated	—	OK	Fractured hyoid; superficial temporal artery	Pneumothorax	—

* Multiple fragment wounds.

comitant injury to the jugular vein. In most of these cases there was accompanying major cervical or craniocerebral injury. One of the three deaths was due to the associated perforating head injury.

In keeping with accepted military doctrine, arteries damaged by a penetrating missile were locally debrided and end-to-end anastomosis performed. In only one case was the carotid arterial laceration repaired by oversewing and this was at the bifurcation of the common carotid where the superior thyroid artery had been avulsed by a low-velocity missile. In the single case of external carotid arterial injury, the vessel was ligated. In all but three other cases, the vessels were mobilized and end-to-end anastomosis performed. In two cases common carotid arterial loss was so extensive that 5-cm lengths of autogenous saphenous vein was used to bridge the defect. Both patients did well despite the need for 100-minute and 55-minute occlusion of the carotid artery.

In one casualty a 3-cm Dacron graft was used to

bridge the defect. Postoperative aphasia and contralateral weakness of the hand gradually cleared, but on clinical grounds, it is suspected that the graft clotted. In this case, both saphenous veins were damaged by multiple fragment wounds of the extremities.

Common carotid occlusion time exceeded 55 minutes in nine patients. In one patient occlusion was for 100 minutes. The only neurologic deficit was in the patient already referred to where occlusion of 80 minutes and insertion of a Dacron graft resulted in temporary contralateral neurological deficit.

These patients were young men with good vessels. Care was taken to provide adequate and often massive whole blood replacement in order to assure adequate perfusion pressures to the brain via collaterals while the carotid artery was clamped. Under these circumstances there need be no haste in performing a meticulous repair. Anticoagulants were not employed in these casualties suffering multiple injuries.

TABLE 2.—*Innominate Artery Injury (DaNang)*

Case No.	Injury	Incision	Repair	Course	Comments
13	1.5-cm laceration of innominate	Supraclavicular sternal split and 4th intercostal	—	Died during induction	Shock on admission Fragment in mediastinum
14	2-fragment laceration 2-cm innominate resection	Sternal split	Resection and anastomosis	OK 5 weeks	Venous distension and shock on admission

TABLE 3.—*Thyroid, Hyoid, Cricoid, Tracheal, Larynx, and Pharynx Injuries (DaNang)*

Case No.	Injury	Incision	Repair	Other injuries	Course	Comments
15	MFW,* small hole anterior trachea	Thyroidectomy and sterno-mastoid	Tracheostomy	Lacerated brachial artery (anastomosed), enucleation, left eye	OK	—
16	AK-47 thyroid cartilage and recurrent laryngeal nerve	Thyroidectomy	Closed with drain	—	OK 12 days	No vocal cord damage
17	Avulsion mid-1/3; thyroid cartilage; cords intact	Laryngeal pyriform sinus	Stent between vocal cords; tracheostomy	—	OK 5 days	—
18	GSW;† loss of 20% thyroid cartilage; damaged vocal cord	Thyroidectomy	Laryngeal stent; tracheostomy	—	OK 3 days	—
19	GSW; hole trachea; cricoid cartilage shot away	Thyroidectomy	Tracheostomy through hole	Small bowel evisceration	OK 14 days	—
20	Fragment wound, pharynx	Sternomastoid	Pharyngeal wound closed and drained	MFW; extremities, traumatic amputation; intracranial fragments	OK 5 days	Subcutaneous air and pneumothorax on entry
21	Fragment perforation thyroid, esophagus and trachea	J-shaped thoracotomy	2-layer closure, esophagus and tracheostomy	Craniotomy	OK 3 days	—
22	Laceration pyriform sinus, larynx and vocal cord	Through wound	Tracheostomy; laryngeal stent; wound closed with drain	Brachial plexus contusion	OK 2 days	Swelling at right side neck on admission
23	Fragment perforation anterior trachea	Thyroidectomy	Did not close hole in trachea; no tracheostomy	—	OK 3 days	Hoarse preoperative; subcutaneous air; despite expectant therapy; OK on evacuation
24	AK-47; fractured larynx; loss vocal cord	Thyroidectomy	Tracheostomy; laryngeal stent	MFW, extremities and abdomen; multiple small bowel perforations; gram-negative shock; eviscerated	OK 18 days	Developed T-E fistula 13th day; closing at time of evacuation
25	Fragment laceration hypopharynx; fractured hyoid	Thyroidectomy	Tracheostomy and repair laceration	—	OK 3 days	No subcutaneous air
26	Hole thyroid cartilage	Thyroidectomy	Tracheostomy; repair laceration and drain	Intracranial fragments inaccessible; asymptomatic; MFW, extremities	OK 3 days	Airway obstruction on admission; esophagoscopy negative
27	Lacerated thyroid cartilage and vocal cord	Pyriform sinus	Tracheostomy, laryngeal stent	—	OK 11 days	—
28	Perforated pyriform sinus	Laryngeal pyriform sinus exploration	Tracheostomy; laryngeal stent on 6th postoperative day	Pneumomediastinum	—	Subcutaneous air; pneumomediastinum; fistula 6th day, healed by 14th day
29	Hyoid shattered; GSW hole pharynx; hole esophagus	—	Wounds closed and drained	MFW, extremities including graft femoral artery, pneumothorax, etc	OK 20 days	Cardiac arrest in triage; resuscitated; T-E fistula 8th day
30	MFW, avulsion larynx, external maxillary artery	Bilateral sternomastoid	Tracheostomy, tube thoracostomy, laparotomy	Multiple small bowel lacerations; MFW, extremities; amputation leg and brachial artery repair	OK 6 days	Maxillary artery ligated

* MFW—multiple fragment wounds.

† GSW—gunshot wound.

There were three deaths in these 12 carotid arterial injuries. One was due to associated craniocerebral injury; another patient bled to death into his chest from an innocuous-looking penetrating wound of the lower neck as major efforts were being directed toward staunching hemorrhage from femoral arterial and multiple small bowel injuries. The final casualty had (at postmortem examination) the bad luck to have an anomalous take-off of his vertebral artery from the carotid artery distal to the point low in the neck where a fragment had severed his common carotid artery. He died 12 hours postoperatively. Occlusion time was 60 minutes.

Innominate Artery.—As detailed in Table 2, two patients had lacerations of the innominate artery. Both were approached through a sternal splitting incision as an emergency measure to control hemorrhage. One patient died during induction of anesthesia. The other survived two fragment wounds in the artery which required resection of 2 cm of the innominate artery with subsequent end-to-end anastomosis. He was alive and well five weeks later.

Injuries of the Larynx, Cervical Cartilages, and Cervical Trachea.—Table 3 summarizes data relating to the 16 injuries involving the thyroid, hyoid, and cricoid cartilages as well as those of the larynx, hypopharynx, and cervical trachea.

As emphasized in previous studies, subcutaneous air may be the only reliable indication of underlying damage to the airway following penetrating injuries of the neck. Only four of the 16 patients did not have subcutaneous air on admission to the triage area. The remainder developed obvious air leaks shortly thereafter.

Preoperative examination involved direct visualization of the cords when feasible, since hoarseness is a notoriously unreliable means of judging vocal cord paralysis or damage. In three cases where esophageal injury was suspect preoperative or intraoperative, esophagoscopy was also performed.

The structures injured roughly correspond to their size and vulnerability. The trachea was violated in five patients, in one of whom, there also was perforation of the esophagus. In five other patients the thyroid cartilage was primarily injured. In four patients, one or both vocal cords were directly damaged. The larynx, pharynx, pyriform sinus, hypopharynx, and cricoid cartilages were injured in one or two instances, each as documented in Table 3.

These injuries were usually explored through some variant of a thyroidectomy incision, as detailed in Table 3. Tracheostomy was performed in all but one

of the 13 injuries in which the trachea or larynx were involved.

Laryngotomy was routinely performed through the existing hole in the thyroid cartilage. When the missile entered the side of the larynx, a lateral laryngotomy through the pyriform sinus was employed. Midline laryngotomy through an intact cartilage was not found necessary. The laryngotomy incisions were routinely closed tight with interrupted sutures. The incisions and debrided area were widely drained in every instance.

Laryngeal stents were placed in the six wounds where there was appreciable destruction of thyroid cartilage. The stents were tethered from above and below through a tracheostomy. In case 17 a "keel" stent was placed between the vocal cords to prevent adhesions and to provide internal support to the damaged larynx.

Damaged bits of hyoid cartilage were removed, but every fragment of the cricoid ring that could be salvaged was used to maintain this structure which is vital for a functioning airway and vocal apparatus. Gaps or tears in the pharyngeal or laryngeal mucosa were closed tightly and the wound widely drained. Every reasonable attempt was made to achieve skin coverage over the injured thyroid and cricoid cartilages.

One tracheo-esophageal (T-E) fistula developed on the thirteenth postoperative day in patient 24 who had an AK-47 injury of the larynx. No esophageal injury was noted at the time of initial surgery. The high-velocity bullet probably caused injury "en passant" to the esophagus which subsequently broke down. Despite associated extensive abdominal injury, the patient recovered. The tracheo-esophageal fistula was almost closed when the patient was evacuated on the 18th postinjury day.

The subsequent reconstructive phases of these injuries were performed in other hospitals along the chain of evacuation and are not within the scope of this study.

Denver General Hospital Experience

A summary of the 13 patients with penetrating injuries of the neck treated at the Denver General Hospital is documented in Table 4. Ten of the 13 injuries were from pistols, shotgun pellets, or low-velocity rifles. The remaining three injuries were stab wounds. Only two of the 13 injuries merely involved the skin, muscles, and nonvital blood vessels. Since a part of this study was a retrospective analysis of records, there were undoubtedly other minor pene-

TABLE 4.—*Penetrating Cervical Injuries, Denver General Hospital Experience*

Case No.	Missile	Incision	Injury	Course	Treatment and Comments
1	GSW* to right side neck	Thyroidectomy	Jugular vein severed	OK	Associated colon injury; jugular vein injury not immediately recognized
2	GSW base of right side neck	Resect clavicle, sternal split, and 3rd interspace thoracotomy	Subclavian vein, subclavian artery, jugular vein	OK	Original attempts to control bleeding unsatisfactory; required thoracotomy
3	GSW base of left side neck	Thyroidectomy	Subclavian vein	Died in emergency room	Inappropriate attempt to control bleeding externally
4	Stab wound left side neck	Thyroidectomy	Thoracic trachea laceration	OK	Tracheostomy
5	GSW left side neck	Thyroidectomy; 7 days later thoracotomy to repair false aneurysm of innominate artery	Esophagus (initial), innominate artery, false aneurysm	OK	Original injury esophageal perforation (drained); late ischemia right arm found due to false aneurysm innominate artery—repaired
6	GSW neck	Thyroidectomy	Laceration, esophagus	OK	Drained
7	Stab wound left side neck	4th interspace thoracotomy	Subclavian artery laceration	OK	Massive intrathoracic hemorrhage required emergency thoracotomy; subclavian artery ligated
8	GSW left side and neck	Thyroidectomy	Soft tissue only	OK	
9	Shotgun pellet left side neck	Thyroidectomy	Soft tissue only	OK	
10	Self-inflicted shotgun wound left side neck	Thyroidectomy	Carotid artery at bifurcation	Died 12 hours post-operatively	Hemiplegic on admission; carotid bifurcation ligated
11	GSW right side neck	Sternomastoid and 4th interspace thoracotomy	Lacerated esophagus	OK	Mediastinal hematoma explored, but no major damage; esophageal lesion drained
12	Stab wound left supraclavicular area	Sternal split plus 4th interspace thoracotomy	Brachial plexus, subclavian artery, inferior thyroid artery, vertebral artery	Brachial plexus palsy	Subclavian artery repaired; other arteries ligated
13	GSW right side neck	Thyroidectomy	Jugular vein	OK	Vein ligated

* GSW—gunshot wound.

trating wounds of the neck that were not included in the survey.

Two of the 13 patients died. One bled to death in the emergency room while ineffective attempts were made to control hemorrhage from a gunshot wound of the subclavian vessels solely via a supraclavicular incision. Emergency thoracotomy with control of bleeding by pressure applied from within the thorax would have been the appropriate maneuver.

The other death occurred in a patient whose left neck was all but blown away by a self-inflicted gunshot wound. He was hemiplegic on admission and required ligation of the carotid vessels. He died 12 hours later.

Of the eight major vascular injuries, four involved the subclavian vessels; two, the jugular vein; and one each, the carotid artery and innominate artery. The latter injury occurred from a pistol bullet that entered the left chest, tangentially creased the innominate artery at its bifurcation, and continued its course fracturing the right humerus. The innominate injury

declared itself as a diminished pulse in the right arm at the time of admission. Not until two days later was a mediastinal murmur detected which proved to be a huge false aneurysm. The lesion was repaired without complications.

The four subclavian vessel injuries represent a much higher incidence than in the military experience; civilian stab wounds are often directed at the base of the neck and directed downward. Low-velocity civilian gunshot injuries to the clavicular area are likely to survive; whereas the military counterpart caused by high-velocity missiles are likely to be immediately lethal. Protective body armor undoubtedly saves many injuries of the subclavian and innominate vessels from low-velocity missiles among the military.

The relatively greater incidence of subclavian vessel injury accounts for the use of a sternal splitting incision to control hemorrhage in three cases. Familiarity with this incision in exposing the mediastinum for elective open cardiectomy operations also un-

doubtedly increases the use of this approach to the great vessels at the base of the neck and apex of the mediastinum.

There were three esophageal injuries in these 13 civilian casualties. All were caused by low-velocity gunshot wounds. This compares with only three esophageal injuries among 62 analogous combat casualties. Presumably high-velocity missiles that involve the cervical esophagus are more frequently lethal because they damage the adjacent spinal cord and major blood vessels.

The esophageal lesions were adequately treated by simple drainage.

Comment

Hubay has ably summarized the changes in the methods of managing penetrating wounds of the neck that occurred during World War II. As Fogelman emphasized, one of the more important changes was the early exploration of such wounds. He found mortality to be 6% if the neck was promptly explored compared to 35% if exploration was delayed.

Reports on the management of such injuries in earlier wars provides fascinating reading, but with the benefit of hindsight, the statistics are frightening.

Factors which have effected improvement during the past 30 years have been:

1. Improved methods in establishing an airway.
2. Improved methods of resuscitation.
3. Early and thorough exploration of neck wounds.
4. Development of technique for vascular repair (Korea).
5. Improved techniques for management of injury to the larynx and trachea.
6. Prompt evacuation and definitive surgical care of both military (Vietnam) and civilian casualties.

Current experience must be considered in relation to this historic tradition. Certain principles of wound care, peculiar to penetrating injuries of the neck, have emerged. Many have been proclaimed previously by others.

Airway.—An adequate airway has its classic priority in neck wounds, but may be particularly difficult to achieve in a field flooded by hemorrhage and complicated by partially detached soft tissue, bone, and cartilage. Endotracheal intubation and tracheostomy is mandatory. Vigorous tracheal toilet is usually subsequently required to remove blood aspirated at the time of injury.

Equally lethal and often more insidious is the gradual encroachment on the airway of an expanding

subfascial cervical hematoma. It requires release in order to avoid a dangerous level of hypercarbia.

Resuscitation.—Resuscitation may be complicated by unsuspected violation of the pleural space and subsequent pneumothorax or hemothorax. The unpredictable course of a missile or the downward thrust of a knife blade may lacerate subclavian vessels which bleed more into the chest than is appreciated by external examination.

Proper care lies largely in a high index of suspicion and liberal and early use of tube thoracotomy in cases of doubt. Seldom is it necessary to await roentgenographic confirmation if suspicion is high and the patient fails to respond to other proper resuscitative measures.

Hemostasis.—The mortally injured sequentially die from occluded airway and, next, from uncontrolled hemorrhage. Such is peculiarly true in the neck—crowded as it is with major blood vessels. Hemostasis may be difficult. Pressure occludes the airway and penetrating injuries may lacerate vessels behind bony structures such as the clavicle or sternum.

Emergency measures to achieve hemostasis of life-threatening hemorrhage may occasionally require resection of the clavicle, median sternotomy, or a formal thoracotomy to achieve direct pressure on a torn vessel. Little time should be wasted in efforts to achieve hemostasis from a supraclavicular approach.

At the time of operative exploration the entire chest bilaterally should be prepared and draped if there is suspicion that median sternotomy or thoracotomy might be required to obtain hemostasis. Case 8 from DaNang and case 7 from Denver both demonstrate the wisdom of such a policy. Patient 3 from Denver might have been saved had it been followed.

Suspicion.—The skin wound of entrance may appear innocuous. The experienced wound surgeon is not, however, beguiled, for beneath such a minor laceration may hide a lethal injury. It is easy to promulgate such a dictum, but difficult to practice in a patient who may have literally hundreds of small fragment wounds scattered elsewhere on his trunk and extremities. Some may be obviously life threatening, such as severance of a major vessel in an extremity or obvious penetration of the peritoneal cavity.

Perhaps the safest policy is to consider penetration of the neck in the same fashion as penetration of the abdominal wall. All should be explored. Roentgenograms will assist in localizing the potential sites of injury should there be retained fragments.

Stein in Johannesburg has ably presented the case for expectant treatment of stab wounds of the neck.

His policy is perhaps permissible where logistic and personnel limitations so demand. It should, however, be recognized as a compromise of ideal care.

Subcutaneous air has been a clear indication that some part of the airway has been violated and is a mandatory indication for formal exploration of the neck. In 13 of the 16 cases in the DaNang experience, such air was present on admission; and in the remaining patients proven to have airway involvement, subcutaneous emphysema appeared within two hours of observation.

This sign is particularly helpful as it provides a clear indication for formal cervical exploration in the very patient in whom there may otherwise be doubt. In the presence of major tissue injury in the neck, debridement and exploration is obviously required. Air may be blowing out the large soft tissue defect. Subcutaneous air accumulates beneath intact skin perforated perhaps only by a hole small enough to permit entrance of a stab blade or a missile fragment.

Exploration of the Wound.—The concentric rings of cervical fascia provide three lines of defense against external hemorrhage from a lacerated vessel deep in the neck. Tamponade may occur even from injuries of the carotid artery. The only external evidence may be an expanding hematoma. The physician exploring even small, innocent-looking, cervical perforations must therefore be emotionally and professionally prepared to deal with an unexpected hole in a major vessel.

The very depth of the wound must be visualized. In two patients with low-velocity wounds in the Denver experience, the surgeon had completed his exploration satisfied that there was no major vessel damage. Encouragement to take one more look a little deeper in the wound uncovered a laceration of the internal jugular vein in one case and in the carotid artery in another!

Repair of Vascular Injuries.—The techniques of repair for vascular injury in the neck are essentially those that pertain elsewhere. Skin incisions should parallel the vessel to provide adequate exposure. Vessels damaged by high-velocity missiles require debridement. End-to-end anastomosis of the mobilized vessels is preferred, but, if a significant segment of vessel is lost, an autogenous vein graft can be employed.

If there is adequate blood replacement prior to cross-clamping the carotid or innominate artery, there apparently need be no inordinate hurry in performing a meticulous arterial anastomosis. Occlusion times were tolerated, up to 100 minutes in one combat casualty. Obviously, pre-existing occlusive

disease will diminish the safe carotid or innominate artery occlusion time.

Damaged veins are best ligated.

Esophageal Injuries.—There were only three esophageal injuries in the 62 combat casualties, whereas there were an equal number in the total of 13 civilian neck injuries. High-velocity military missile injuries of the esophagus are likely to be immediately lethal because of accompanying spinal cord damage.

Where doubt exists as to esophageal involvement, intraoperative esophagoscopy can be performed. In neither the civilian or military experience were radiopaque dye studies used to confirm the presence of an esophageal perforation.

Simple drainage is the cornerstone of treatment of these wounds. Extensive esophageal loss would obviously require more complex closure or diversion. Neither was required in this combined series.

Tracheal Injuries.—Small holes in the trachea were utilized for tracheostomy if conveniently located. If not, they were closed after debridement and a distant tracheostomy performed. There were no injuries in which circumferential tracheal anastomosis was required.

Laryngeal Injuries.—As documented in detail, injuries of the larynx, pharynx, and vocal system were treated according to accepted otolaryngologic techniques.

When there was more than incidental damage to the thyroid cartilage or any significant disruption of the larynx, a temporary laryngeal stent was employed to provide laryngeal support. These stents were tethered above and below through a tracheostomy. Removal of the stent was delayed until after evacuation from DaNang.

Twenty-five of 62 (40%) of the documented military injuries and two of the 13 civilian neck injuries involved only the skin and minor soft parts. This implies that in more than half of the cases of penetrating injuries of the neck that a major structure was involved. Even accepting that some minor perforations might have been deemed too insignificant to record, it still leaves a sufficiently ominous basis for demanding a widespread familiarity with this type of lesion. Its initial care is not difficult, but improper treatment results in an inordinate mortality and morbidity.

Conclusions

A simultaneous study of 75 patients with penetrating injuries of the neck forms the basis of this study. Sixty-two were combat casualties treated soon

after injury in the US Naval Support Activity Hospital in DaNang, Republic of Vietnam. The remaining 13 cases were cared for at the Denver General Hospital.

Twenty-nine of the 75 patients (39%) involved laceration of major blood vessels. Sixteen of the 62 military injuries (26%) primarily involved the larynx, cervical trachea, and pharynx.

On the basis of this experience the following principles are advocated in the initial care of patients with penetrating cervical injuries: (a) Innocent wounds of entry frequently hide life-threatening wounds of major blood vessels, the airway, or esophagus. (b) Initial resuscitation usually requires tracheal intubation or tracheostomy. Resistance to usual resuscitative measures should raise the possibility of hemothorax or pneumothorax. Emergency thoracotomy may be required to achieve initial hemostasis. (c) The entire neck and anterior chest should be

cleansed and draped in order to allow extension of the incision to permit removal of the clavicle, splitting of the sternum, or thoracotomy in the fourth interspace. (d) Cervical wounds must be explored to their depth, for they frequently reveal major blood vessel injury temporarily tamponaded beneath the firm cervical fascia. (e) Carotid and even innominate artery occlusion is tolerated for over an hour if the patient is normotensive. Arterial repair should not be hurried. (f) The validity of accepted means for management of esophageal, tracheal, and laryngeal wounds has been confirmed.

Surgeons who only occasionally are responsible for the management of penetrating wounds of the neck should familiarize themselves with techniques which are simple to perform but which result in a high morbidity if neglected.

(The references and discussion may be seen in the original article.)

MYCOPLASMAL PNEUMONIA ¹

A STATEMENT BY THE COMMITTEE ON THERAPY

"Mycoplasmal Pneumonia" reprinted by permission from the American Review of Respiratory Diseases 100:2, August 1969, pp. 254-255. This statement is endorsed by the following members of the Therapy Committee of the American Thoracic Society: Donald L. Brummer, M.D.; Aaron D. Chaves, M.D.; David W. Cugell, M.D.; Helen A. Dickie, M.D.; Norman G. Hepper, M.D.; Alan K. Pierce, M.D.; Morton M. Ziskind, M.D.; and David G. Simpson, M.D., Chairman.

The term "Primary Atypical Pneumonia" was first applied to any acute nonbacterial pneumonia without typical lobar consolidation, but when Reimann reported an epidemic in 1939 the presence of a distinct syndrome was widely recognized for the first time. Originally it was thought that atypical pneumonia had only one cause, but modern serologic and microbiologic studies have demonstrated that it can be caused by a number of agents. Atypical pneumonia associated with cold agglutinins was shown by the Commission on Acute Respiratory Diseases during World War II to be caused by a filterable agent which was subsequently (1944) isolated by Eaton. In a series of studies using serologic and epidemiologic techniques it was established by a number of investigators that the so-called Eaton agent was an important cause of primary atypical pneumonia. Following the identification of this agent as a member of the genus mycoplasma, Chanock and his associates were able to culture the organism on a cell-free medium.

Although other strains of mycoplasma that regularly inhabit man are pathogenic, *Mycoplasma pneumoniae* is the only one that has been proven clearly to cause respiratory tract disease. The mycoplasma, previously referred to as pleuro-pneumonia-like organisms (PPLO), are approximately 150-200 m μ in diameter. Diagnosis by culture and serologic examination requires techniques beyond the scope of the average diagnostic laboratory. When cultures on artificial media are positive, colonies appear in about two weeks. Complement fixing antibodies appear in the serum at about the tenth day, and a rising titer during convalescence is necessary for diagnosis. Treatment must, therefore, be carried out without laboratory confirmation.

Studies on volunteers indicate that the incubation period of the disease is 7-14 days. The onset is less abrupt than in pneumococcal pneumonia, and systemic symptoms of fever and malaise usually accompanied by headache, myalgia, chilly sensations, and sore throat may precede respiratory symptoms by one to three days. Cough is invariably present and may be severe enough to cause rib fracture. The

¹ Reprints may be requested from your state or local Christmas Seal association.

sputum is scanty and is often mucopurulent without predominant pathogenic bacteria. Other symptoms such as nausea, vomiting, coryza, laryngitis, earache, diarrhea, and skin rashes occur less frequently. Although substernal burning may be present, pleural pain is uncommon. The pulse may be relatively slow in relation to fever. The pharynx is often slightly injected and the ear drums are occasionally inflamed. Examination of the chest usually reveals only fine, moist rales without evidence of gross consolidation. In contrast to the meager physical findings, chest roentgenograms may demonstrate extensive disease. The infiltrates are more common in the lower lung fields and involve one or more lung segments. They are unilateral in about 85 percent of the cases. Pleural effusions are rare. Roentgenographic pulmonary infiltrates may not appear before the fifth day of illness and in untreated cases may progress for several days.

Routine laboratory procedures are not diagnostic. The white blood cell count is usually normal, but it may exceed 10,000 mm³ in up to 25 percent of the cases. The erythrocyte sedimentation rate is usually normal. Rarely, direct Coombs positive hemolytic anemias and false positive serologic reactions for syphilis have been described. A fourfold rise or high titers of cold agglutinins in serum have been demonstrated in about half the patients with proven mycoplasmal pneumonia; however, significant titers may also be seen in atypical pneumonia caused by other agents. Only specific serologic tests that detect antibodies against *M. pneumoniae* are diagnostic.

Many diseases may enter into the differential diagnosis of mycoplasmal pneumonia. It is usually distinguishable from bacterial pneumonia by clinical differences, a normal white blood count, and the absence of predominant pathogenic bacteria in the sputum. Unlike bacterial pneumonia, mycoplasmal pneumonia has been reported frequently in the 5—20-year-old age group and does not have a seasonal incidence; it occurs in epidemics as well as sporadically. Primary tuberculosis, histoplasmosis, and coccidioidomycosis may easily be confused with mycoplasmal pneumonia.

The correct diagnosis is frequently made only retrospectively by serial complement fixation titers, skin tests, isolation of the causative organism, or progression to chronic pulmonary disease. The pneumonia of psittacosis and Q fever can be differentiated from mycoplasmal pneumonia only by complement fixation tests. Many viruses may cause atypical pneumonia including influenza, parainfluenza, ECHO, Cocksackie, respiratory syncytial, and adenovirus

(especially in military recruits). The clinical findings in such cases may be indistinguishable from mycoplasmal pneumonia. During epidemics of viral pneumonia, a presumptive diagnosis of viral etiology can be made.

The course of untreated mycoplasmal pneumonia is typically prolonged. The symptoms of fever, headache, malaise, and fatigue usually disappear between the third and tenth days after onset, but may persist up to four weeks. Clearing of cough, rales, and the evidence of clearing shown on the roentgenogram proceed at a slower rate, most frequently occurring between 7 and 21 days after onset. However, it may be 4 to 6 weeks before the chest film becomes completely clear. Death from mycoplasmal pneumonia is rare even in untreated cases.

Mycoplasma are not sensitive to the penicillins, probably because they lack cell walls. In 1961 Kingston and associates in a double blind study clearly demonstrated that demethylchlortetracycline (Declomycin®) was effective in treating proven mycoplasmal pneumonia. Subsequently, Rasch and Mogabgab confirmed the effectiveness of tetracycline and showed that erythromycin yields similar results. Despite the favorable clinical response to antibiotics, the organism may persist in the oropharynx for one to three months, and transmission to close contacts may continue.

The physician must first exclude bacterial pneumonia by history, physical examination, white blood count, and examination of the sputum for pathogenic bacteria. Epidemiologic data may suggest the probable cause of the illness. It is reasonable to institute treatment with either erythromycin or one of the tetracyclines when an atypical pneumonia is encountered. If pneumococcal pneumonia cannot be excluded, erythromycin is probably the preferred drug. They should be administered in recommended doses (1.5 g daily) for at least one week. If the pneumonia is due to mycoplasma, clinical improvement can be expected within five days, and the roentgenographic evidence of disease should not increase.

A vaccine made from inactivated *Mycoplasma pneumoniae* has been reported, and early results have been encouraging. It is likely that a commercial vaccine will be developed in the near future which will be recommended for certain high risk groups such as school children, military recruits, college students, and inmates of institutions.

(The references may be seen in the original article.)

ASSOCIATION OF *MYCOPLASMA PNEUMONIAE* INFECTION WITH PRIMARY ATYPICAL PNEUMONIA^{1,2}

John P. Griffin³ and York E. Crawford, *American Review of Respiratory Disease* 100:2, August 1969, pp. 206-212.

Summary

A controlled epidemiologic experiment was conducted at the Great Lakes Naval Training Center to measure the relationship of *Mycoplasma pneumoniae* infection and the syndrome of primary atypical pneumonia. Recruits admitted with pneumonia were matched with suitable control subjects with nonrespiratory illness. Using a two-plate cultural system with both aerobic and anaerobic incubation, respiratory secretions yielded *M. pneumoniae* in 11 patients. *Mycoplasma salivarium* and *M. pharyngis* were equally prevalent in both the pneumonia group and the control group. With the addition of seroconversion of complement-fixing antibodies as a criterion of infection, *M. pneumoniae* was implicated in 20 percent of patients with pneumonia. Cold agglutinin reactivity was significantly related to this infection. The association of *M. pneumoniae* with atypical pneumonia was significant.

Introduction

Clinical studies of primary atypical pneumonia in both military and civilian populations have demonstrated cultural or serologic evidence of *Mycoplasma pneumoniae* infection in a variable proportion of those cases associated with the development of cold hemagglutinins. Epidemiologic investigations of Marine recruits by Chanock and co-workers, and of civilian participants in a group health program by Grayston and associates, have shown a significant association of *M. pneumoniae* infection with the syndrome of primary atypical pneumonia.

During an epidemic of nonbacterial pneumonia at the Naval Training Center, Great Lakes, Illinois, in the fall of 1961, by measurement of complement-fixing antibodies in paired serum specimens, no significant difference was found in the prevalence of *M. pneumoniae* infection between recruits with pneumonia and those with no respiratory symptoms. The following year, a clinical study was conducted in this

same population to detect *M. pneumoniae* infection in recruits admitted to the U.S. Naval Hospital with primary atypical pneumonia. Combined cultural and serologic methods demonstrated infection with this agent in 17 percent of such pneumonia cases. In consideration of these findings at Great Lakes, it was appropriate to perform a controlled epidemiologic investigation to test the specific association of *M. pneumoniae* infection with the syndrome of primary atypical pneumonia.

Materials and Methods

Recruits admitted to the medical dispensary at the Great Lakes Naval Training Center between September 1 and October 31, 1965, comprised the study population. The unique characteristics of this population including the various environmental factors and training procedures involved in an understanding of the epidemiology of "recruit" pneumonia have been outlined by Miller and associates. In a 10 percent sampling of recruits admitted with pneumonia in the fall of 1961, they found that none of 88 patients showed *Diplococcus pneumoniae* on sputum culture. Similarly, bacteriologic confirmation of pneumococcal infection was noted in only 2 of 300 randomly selected recruits with pneumonia admitted to the U.S. Naval Hospital, Great Lakes in the winter of 1962-1963. On chest roentgenograms nonbacterial pneumonia of recruits has appeared in the form of soft, mottled, or diffuse infiltrates, usually in the lower lung fields, and often has been consistent with dependent segmental pneumonitis and atelectasis. In the present study, recruits admitted daily with an acute febrile respiratory illness associated with pulmonary infiltration of this type formed the group termed primary atypical pneumonia. The control group was composed of recruits similarly admitted to the medical dispensary for afebrile nonrespiratory conditions. The control patients were matched as to the date of admission to the dispensary and the stage of basic training, but they were selected from a different training company in order that the possibility of a more than casual contact with the experimental group could be eliminated.

Shortly after admission, each patient's throat was swabbed and cultures for mycoplasma were made. An acute phase blood sample was obtained by veni-

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² Investigation conducted under Research Work Unit MF 022.03.07-4017, Bureau of Medicine and Surgery, Navy Department, Washington, D.C. The opinions and assertions made herein are those of the authors and are not to be construed as official or as reflecting the view of the Navy Department or of the Naval Service at large.

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puncture at this time, and a convalescent phase blood sample was obtained two weeks later. After the blood clotted, the serum was extracted at 37° C to prevent homologous hemadsorption and loss of cold hemagglutinins, which are reactive at room temperature. Cold agglutinins were titered by serial dilution of serum in 0.9 percent saline and incubated overnight at 4° C in the presence of 0.2 percent fresh Group O erythrocytes, as previously reported. The titer was expressed as the reciprocal of the final serum dilution showing definite hemagglutination reversible at 37° C. Titers of 32 or greater were considered indicative of the presence of these cold antibodies. Streptococcus MG (ATCC No. 9895) agglutinins were measured by the method of Thomas and co-workers. Fourfold or greater increases in titer of paired serum specimens were considered significant.

The Kolmer one-hour method was used to measure complement-fixing antibodies to *M. pneumoniae*. Endpoints were recorded as the smallest amount of serum that completely fixed 2 units of complement in the presence of 2 units of antigen under standard conditions. The M-52 strain of *M. pneumoniae* (ATCC No. 15293) isolated from a recruit with pneumonia at Great Lakes was prepared as the complement-fixing antigen by adaptation of a phenolization procedure of Chanock. Anticomplementary effects were reduced by use of gamma-globulin-free horse serum in the broth culture, and by heating the antigen suspension in a boiling water bath for 15 minutes. Seropositivity consisted of fourfold or greater increases in titer of complement-fixing antibodies in paired serum specimens.

A two-plate system for the isolation of mycoplasma was used, inoculating the entire surface of each plate with one half of the pharyngeal swab from that patient. One plate was prepared from 70 percent PPLO agar, 20 percent horse serum, and 10 percent fresh yeast extract according to the formula of Chanock and associates. Addition of 0.002 percent methylene blue chloride to suppress growth of other mycoplasma species resulted in a medium selective for *M. pneumoniae* when incubated at 37° C under aerobic conditions in paraffin-sealed plates for as long as 30 days. The second plate in this system was used for the isolation of anaerobic mycoplasma. It consisted of 89 percent PPLO agar, 10 percent horse serum, and 1 percent yeast autolysate according to the formula of Shklair and associates. These plates were incubated at 37° C in anaerobic jars containing an atmosphere of 95 percent nitrogen and 5 percent carbon dioxide for up to 15 days. The pH of each medium was appropriately adjusted, because optimal

pH for the isolation of *M. pneumoniae* has been observed to be 7.0 to 8.0, and that for other human respiratory tract mycoplasma 6.0 to 7.0. Colonies demonstrating typical mycoplasmal morphology, i.e., small spherules of *M. pneumoniae* in the aerobic system, and "fried-egg" appearance of other mycoplasma in the anaerobic system, were transferred in agar blocks to the surface of other plates for immunologic identification. Evidence of inhibition of colonial growth by homologous antibody was sought by application of a multitipped paper disc soaked with species-specific antisera prepared in rabbits to the surface of the inoculated plate according to the method of Clyde. The identification of *M. pneumoniae* was further confirmed by transferring a block of colonies facing downward onto an agar plate containing 2, 3, 5-triphenyltetrazolium chloride. Kraybill and Crawford have demonstrated that *M. pneumoniae* is the only mycoplasma of human origin that reduces tetrazolium under aerobic conditions. Therefore, a pink color change was evident in the test block after three to six days of incubation at 37° C when *M. pneumoniae* colonies were present.

Results

During this study epidemiologic and serologic surveillance in nonimmunized cohort recruit companies demonstrated no epidemic illnesses nor evidence of influenzal infection. Endemic acute respiratory disease of the undifferentiated type was associated with laboratory evidence of adenovirus type 4 infection in this cohort group. Polyvalent inactivated influenza virus vaccine and benzathine penicillin G as a prophylaxis against group A beta-hemolytic streptococcal infection were routinely administered to recruits participating in this study, with the exception of those with a history of associated hypersensitivity reaction. Throat and sputum cultures for bacteria were utilized as requested by dispensary medical officers independent of this investigation. When used, such cultures failed to reveal pneumococci or beta-hemolytic streptococci from recruits in this study.

The relative distribution of serologic reactions in Navy recruits with atypical pneumonia and nonrespiratory illness, respectively, is portrayed in figure 1 (not shown). The afebrile nonrespiratory conditions represented in the control group consisted of traumatic, dermatologic, and psychiatric disorders. Because of the high prevalence of specific and non-specific respiratory conditions in the recruit population it was considered inadvisable to attempt to eliminate patients from the control group who were afflicted with any respiratory symptoms in addition to

the nonrespiratory illness for which they were admitted. The most frequently observed serologic abnormality was an elevation of cold hemagglutinins. This was noted with a considerably greater frequency in pneumonia patients (32 percent) than in the nonrespiratory group (14 percent). Because measurement of cold hemagglutinins is used as a screening procedure for *M. pneumoniae* infection, maximal sensitivity of the test as noted at a titer of 32 or greater was required. Previous work from this laboratory has shown the validity of this endpoint in predicting *M. pneumoniae* infection, although with some loss of specificity. As in the serologic diagnosis of other infections, a fourfold or greater increase of antibodies in acute and convalescent serum specimens offers the maximal specificity. Such increases of cold agglutinins were noted in 6 pneumonia patients and in none without respiratory illness; however, more than one half of proved *M. pneumoniae* infections were missed by using this criterion of cold agglutinin significance. Seroconversion of complement-fixing antibodies to *M. pneumoniae* was detected in 12 patients, with 18 percent in the pneumonia group as compared to 4 percent in the control group. Significant increases in streptococcal MG agglutinins were infrequently observed; 7 percent of pneumonia patients and 4 percent of the control subjects exhibited this change. Although a definite trend was evident toward a greater relative frequency of all three antibody responses in the atypical pneumonia group as opposed to the control group, it was apparent that some *M. pneumoniae* infections occurred in the control group. This probably represented the subclinical form of the infection that has been recognized previously in military populations.

The frequency of isolation of *M. pneumoniae* by the selective medium used in both the pneumonia and control groups is shown in table 1. Ten percent of patients sampled yielded this organism from their pharyngeal secretions. Although the total number of isolates was small, this agent was more frequently isolated from pneumonia patients than from nonrespiratory control subjects; 16 percent of the cultures from the former group yielded

TABLE 1.—Frequency of Isolation of *Mycoplasma pneumoniae* in Navy Recruits with Atypical Pneumonia and Nonrespiratory Illness*

Patient Group	Number Sampled	Number of Cultures Containing <i>M. pneumoniae</i>
Atypical pneumonia	56	9 (16)†
Nonrespiratory illness	56	2 (4)
Total	112	11 (10)

* Pharyngeal cultures on methylene-blue containing PPLO agar.

† Numbers in parentheses are percentages.

the organism as compared to 4 percent in the latter group. The 2 patients with nonrespiratory illness who demonstrated the presence of this microorganism in their throats consisted of one patient with a post-traumatic cellulitis of the foot, and a second patient with an acute nonspecific gastroenteritis. The appearance of serum antibodies to *M. pneumoniae* in the first of these control patients during convalescence confirmed an active current infection whereas the second patient demonstrated a high but stationary titer in acute and convalescent phase serum specimens consistent with preexisting recent infection.

The frequency of isolation of anaerobic mycoplasma from the oropharynx of Navy recruits with atypical pneumonia and with nonrespiratory illness, respectively, is seen in table 2. These organisms isolated on Shklair medium in all instances grew in colonies of the "fried egg" type, and also grew more rapidly than the pathogenic *M. pneumoniae* species. Anaerobic mycoplasma species were cultured from

TABLE 2.—Frequency of Isolation of Anaerobic *Mycoplasma* in Navy Recruits with Atypical Pneumonia and Nonrespiratory Illness

Organism	Atypical Pneumonia	Non-respiratory Illness	Total
<i>M. salivarium</i>	31	28	59
<i>M. pharyngis</i>	7	7	14
<i>M. hominis I</i>	0	1	1
Mixed isolate*	3	8	11
No isolate	11	10	21
Total	52	54	106

* *M. salivarium* and *M. pharyngis*.

the oropharynx of more than three fourths of the patients sampled. Using the method of agar block excision for passage of isolates, it was noted that in most instances a single species was obtained from each patient, although in 3 patients with pneumonia and in 8 patients with nonrespiratory diseases several different species were identified from the same oropharyngeal specimen. The most frequently isolated species was that of *M. salivarium*, which was found in approximately one half of patients sampled. Fourteen patients showed *M. pharyngis* in the oropharynx. Only one control patient and none of the pneumonia patients demonstrated *M. hominis I* on pharyngeal culture. The prevalence of *M. salivarium* was about equal in both the pneumonia group and the control patients. *Mycoplasma pharyngis* was identically distributed between these two groups. No association of any of these anaerobic mycoplasma and the atypical pneumonia syndrome was evident.

Considering the isolation of *M. pneumoniae* to be indicative of infection with this agent, it was of in-

terest to study the complement-fixing antibody response to this agent in the serum specimens of "infected" recruits. A more detailed analysis of the *M. pneumoniae* complement-fixing antibody concentrations in the serum specimens of 11 recruits from whom *M. pneumoniae* was isolated is seen in table 3. The number of patients demonstrating various patterns of reactivity are distributed according to the ranges of their "acute" serum titer and their corresponding "convalescent" titer. Although initial titers were observed to distribute either at or less than 16, or at or more than 128, convalescent titers distributed randomly at 16 or more. If fourfold or greater rises are counted, it is of considerable interest that each of 6 patients with a low initial titer manifested seroconversion of complement-fixing antibodies to *M. pneumoniae*, but none of 5 patients with a high initial titer showed a further rise of such antibodies. This phenomenon previously described by Grayston and associates has been interpreted as an indication of delayed detection of illness relative to onset of infection, as observed in a population of naturally infected subjects. The data illustrate the considerable error involved in serologic estimates of prevalence of *M. pneumoniae* infection in hospitalized patients when seroconversion is used as the only criterion of seropositivity.

The relationship of cold agglutinin reactivity to *M. pneumoniae* infection in 112 Navy recruits is presented in table 4. Of 26 cold agglutinin reactors, 11 showed cultural or serologic evidence of *M. pneumoniae* infection. Conversely, of 14 detected *M. pneumoniae* infections, cold agglutinin reactivity developed in 11. Statistical testing revealed a significant association of cold agglutinin reactivity and *M. pneumoniae* infection in hospitalized recruits at the Great Lakes Naval Training Center during the period of this investigation.

The distribution of *M. pneumoniae* infection in recruits with atypical pneumonia and in those with nonrespiratory illness is shown in table 5, and the association of *M. pneumoniae* infection with the atypical pneumonia syndrome is tested. Of 14 *M.*

TABLE 3.—*M. pneumoniae* Complement Fixation Test Results in Paired Serum Specimens of Navy Recruits from whom *M. pneumoniae* Was Isolated*

First Serum Titer	Second Serum Titer				Fourfold Rises
	16	32 and 64	128 and 256	≥512	
≤16	1	1	2	2	6 of 6
32 and 64	—	—	—	—	—
≥128	—	1	1	3	0 of 5

* Titers are reciprocals of original serum dilutions.

pneumoniae infections, 11 occurred in recruits hospitalized with atypical pneumonia whereas only 3 were detected in the control group. Of the 56 patients with pneumonia, 11 patients or approximately 20 percent demonstrated either cultural and/or serologic evidence of *M. pneumoniae* infection. The P value of less than 0.025 obtained from an analysis of this data supports a significant association of *M. pneumoniae* infection and the syndrome of atypical pneumonia.

Discussion

By use of an anaerobic cultural system it was possible to discover in this study the total recognizable mycoplasmal flora of the human upper respiratory tract. Of patients admitted with nonrespiratory illnesses, 81 percent showed large-colony anaerobic

TABLE 4.—Relationship of Cold Agglutinin Reactivity and *Mycoplasma pneumoniae* Infection in Hospitalized Navy Recruits*

<i>M. pneumoniae</i> Infection†	Cold Agglutinin Reactivity†		
	Positive	Negative	Total
Positive	11	3	14
Negative	15	83	98
Total	26	86	112

* P < 0.005 (Yates).

† Titer ≥ 32.

‡ Isolation or fourfold increase in complement-fixing antibodies.

mycoplasmas on culture of pharyngeal secretions (table 2). As in a prior sampling of recruits without respiratory disease performed by Crawford in this same population, the most frequently isolated species was *Mycoplasma salivarium*. Similarly, in both studies, the only other mycoplasma species to be encountered often was *M. pharyngis*. Mixtures of both species were also apparent in many pharyngeal specimens. *Mycoplasma hominis* I has been detected rarely in throat cultures. Hendley and Jordan have shown that the presence or absence of an upper respiratory infection had no effect on the large-colony mycoplasmal flora of adults. In the present investigation, the data reveal no significant difference in either the number of subjects with anaerobic mycoplasma in the pharynx or the distribution of various species

TABLE 5.—Relationship of *Mycoplasma pneumoniae* Infection and Atypical Pneumonia in Navy Recruits*

Patient Group	<i>M. pneumoniae</i> Infection†		
	Present	Absent	Total
Atypical pneumonia	11	45	56
Nonrespiratory illness	3	53	56
Total	14	98	112

* P < 0.025.

† Isolation or fourfold increase in CF antibodies.

between recruits with pneumonia and those without respiratory illness.

The presence of *M. pneumoniae* infection and the development of cold hemagglutinins are frequently associated events in pneumonia. In reviewing six separate studies, it was noted that in 72 percent to 92 percent of patients with cold agglutinins in pneumonia there was a significant increase in specific antibodies to *M. pneumoniae*. In volunteer experiments using both tissue culture and cell-free agar propagated strains of this organism, cold agglutinins regularly developed in those subjects lacking preinfection *M. pneumoniae* antibodies. Evans and co-workers found cold hemagglutination measurements useful in suggesting this infection; they concluded, however, that this test was relatively insensitive because only 65 percent of patients with proved *M. pneumoniae* infections developed high titers of cold agglutinins. In a prior study the writers noted a significant association of these cold antibodies and *M. pneumoniae* infection in atypical pneumonia ($P < 0.0025$). The data in the present paper confirm this relationship during a later period of time (table 4). Detection of cold agglutinins has been further simplified and their value in detecting *M. pneumoniae* infection has been reaffirmed by use of a rapid screening test.

Cultural or serologic evidence of *M. pneumoniae* infection was detected in 20 percent of patients with atypical pneumonia (table 5). These results are in close agreement with earlier work at Great Lakes in which this infection was demonstrated in 17 percent of patients with pneumonia. Earlier reviews have pointed out the variable prevalence of this agent in pneumonia in different Navy and Marine populations and during different years of surveillance. In a serologic survey of complement-fixing antibodies in Air Force personnel from 1959 to 1966, Mogabgab noted an incidence of 44.3 percent *M. pneumoniae* infection in atypical pneumonia. It has been reasoned that military recruit training offers an environment favorable to the slow but extensive dissemination of this infectious agent. Considered important in this regard are the prolonged close personal contacts, the large size of populations, and the frequent introduction of susceptibles without antibody characteristic of such training camps.

Chanock and associates have shown in a Marine training camp that *M. pneumoniae* infection often is not followed by pneumonia, and that probably 30 percent of recruits experience this infection without

any acute respiratory symptoms. These investigators found that 6 percent of 262 patients with nonrespiratory illnesses showed serologic evidence of *M. pneumoniae* infection. It is, therefore, not surprising that 5 percent of Navy recruits comprising the nonrespiratory illness group in the present study were infected by *M. pneumoniae*.

In an attempt to clarify the etiologic factors of atypical pneumonia cases not associated with *Mycoplasma pneumoniae* infection in this study, further serologic measurements were performed. Seroconversion of complement-fixing antibodies to the adenovirus group antigen was noted in 30 percent of recruits with pneumonia, and in 16 percent of those with nonrespiratory illness.

This epidemiologic investigation was designed to measure a possible relationship of *M. pneumoniae* infection and the syndrome of primary atypical pneumonia at the Great Lakes Naval Training Center. In table 5 the distribution of such infections among groups with pneumonia and those with nonrespiratory illness is shown, and a clear-cut statistical association of *M. pneumoniae* infection and atypical pneumonia ($P < 0.025$) is demonstrated. This finding is in agreement with previous controlled epidemiologic studies in both military and civilian populations and supports the contention that *M. pneumoniae* is a respiratory pathogen of importance in a significant number of young adults hospitalized with pneumonia.

Acknowledgment

The writers thank Dr. Gene H. Stollerman for critical review of this manuscript.

(The figure and references may be seen in the original article.)

Editorial Comment: Considerable interest in *Mycoplasma pneumoniae* is being generated in the current medical literature. Attention is further invited to an article entitled "Mycoplasma Pneumoniae as a Determinant of the Guillain-Barré Syndrome" in The Lancet, 2:7623, Oct 4, 1969. The authors (J.C. Steele, R. M. Gladstone, S. Thanasophon and P. C. Fleming) report 4 cases of neurological illness admitted to The Hospital for Sick Children in Toronto, during the autumn of 1968. Neurological symptoms developed at the height of the serological response to *M. pneumoniae*. They recommend that patients with the Guillain-Barré syndrome, particularly between the ages of 5 and 30 years, should be investigated for mycoplasma infection.



Christmas Is . . .

The photograph on the cover tells it like it really is, for Christmas is many things to many people.

To some of the children pictured on the cover, Christmas is a jolly Marine in a Santa Claus suit.



To a Marine wounded in action, Christmas is a medevac helicopter, the brave men who man them, the fast delivery within minutes to facilities equipped to render definitive treatment, the best statistical prognosis ever achieved in any armed conflict.





To a little baby, Christmas is being warm, dry, clean, fed and loved, and all at the same time, on a hospital ward aboard the USS REPOSE.

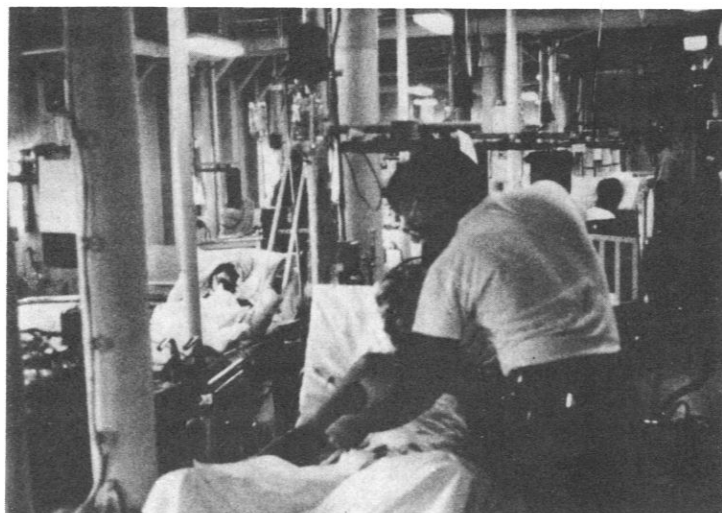


To the Vietnam populace in need of treatment, Christmas is MEDCAPS and DENTCAPS Civic Action Programs which regularly bring medical assistance into the villages and hamlets.

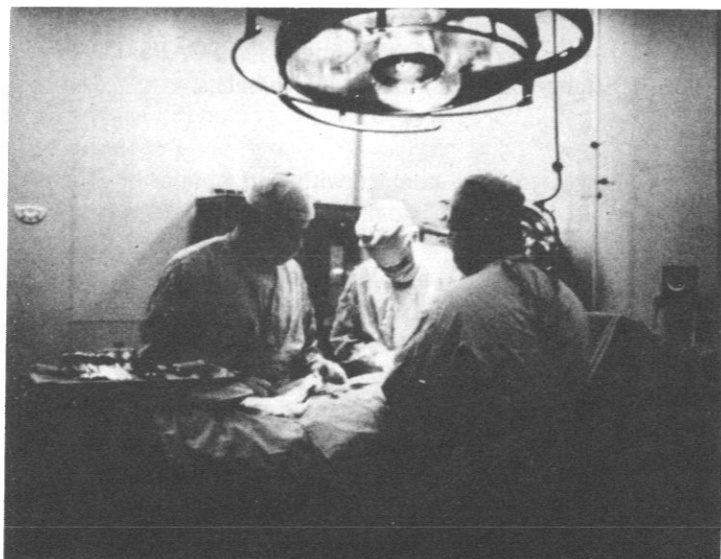
To HM1 Baldrige, Christmas is being allowed to have contact with and obtain medical treatment for the crew of the USS PUEBLO during their captivity.

To a young girl with a cleft palate and lip, Christmas is being made to look and sound like other little girls, thanks to the staff at the 3d Marine Division Children's Hospital.

To children born with ventricular septal defects in Vietnam, Christmas is Dong Ha Children's Hospital, LTs Martin Glasser and Frederick Burkle, Jr., the Navy doctors instrumental in starting the project to send them to San Diego Naval Hospital for corrective surgery, or the 3rd Marine Division which contributed many dollars to help defray trip expenses.



To a large group of dedicated members of the Navy Medical Department who have worked long hours without acclaim, Christmas is the fruition of research endeavors, the benefits to countless future civilian and military patients that will result from the Navy Blood Research Laboratory in Chelsea, Massachusetts; the improved aerial insecticide dispersal apparatus developed at the Navy Disease Vector Control Center at Jacksonville, Florida; the advances in organ transplantation and methods of preserving tissue developed by the Tissue Bank Division at the Naval Medical Research Institute in Bethesda, Maryland; the knowledge acquired by a battle casualty study group at the Naval Hospital, DaNang; the improved treatment capabilities for high-risk patients resulting from shock and resuscitation studies conducted by a Surgical Research Unit at the Navy Station Hospital in DaNang; the increased understanding of physiological changes in body water distribution in heat stress or extensive trauma resulting from Body Fluid Spaces Study being conducted by the Naval Medical Research Unit in DaNang; the improved rehabilitation and cosmetic outlook for maxillofacial injuries as a result of dental research and studies conducted in Vietnam.



To an injured Vietnamese civilian, Christmas is the "international ward" aboard the USS SANCTUARY where medical care is provided with skill and compassion.

To countless Vietnamese children afflicted by misery, Christmas is the 3d Marine Division Memorial Children's Hospital, a lasting tribute to the Marines and Sailors killed in combat while serving in the 3d Marine Division, and the contributions being donated by all who wish to honor this worthy eulogy.

To the Medical Newsletter Staff, Christmas is The Navy Medical Department and the men they support, the opportunity to wish them well, wherever they may be, and Godspeed.



Authorization to reprint the following report has been obtained. It is presented here, not only because of the information provided therein, but because the tone of the account so typifies the spirit of "Navy Corpsmen," without whose untiring efforts so many heroic chapters in the history of Navy Medicine could never have been written.

EXPERIENCES OF THE USS PUEBLO AGER-2 HOSPITAL CORPSMAN

The following observations based on eleven months as a prisoner of the North Korean Communists, as a crewman and Medical Department Representative of the USS PUEBLO AGER-2, are presented with the hope that they will be of interest to other members of the Navy Medical Department. The events leading to and the actual capture of the ship will not be discussed, as they have been widely publicized by various news media during the Court of Inquiry. As the PUEBLO was being escorted into the North Korean port city of Wonsan, I had as the Hospital Corpsman, prepared a large amount of medical supplies, including antibiotics, various other drugs, bandages, and minor surgery sets from my main medical locker. I did this because I knew that in addition to the one fatality resulting from point blank gunfire from a North Korean Patrol boat, and one crewman that I considered seriously wounded with a severe shrapnel wound of the right inner thigh, that there were several other less seriously wounded which would require further medical or surgical treatment. Some of these crewmen I had not seen because my entire time had been devoted to the care of the more seriously wounded. I might add at this point that I was extremely proud of the crew for they unhesitatingly rendered "buddy" aid and care to the less seriously wounded. The importance of a well organized and well planned program of first-aid and self-aid for ships, especially those with only one independent duty corpsman aboard, cannot be overemphasized. I had spent many hours giving the crew first-aid lectures and training, and insisted that each man know the contents of the First-Aid boxes and their location. At the time of arrival in Japan on 1 December 1967, I had completely satisfied myself that every man aboard could, in an emergency, render acceptable first-aid technique to any injured man in the crew. I made sure that my first-aid materials and supplies located in the first-aid boxes were of good quality and of sufficient quantity, and that the boxes were dispensed well throughout the ship. As soon as the ship docked a group of North Korean Army officials came to the ward room of the ship. I identified myself as a Medical Corpsman and re-

quested to be allowed to remove my prepared medical gear from the ship to our place of detention. The supplies were overturned and thrown all over the ward room deck. I was told I could remove nothing from the ship except myself, and was removed from the Pueblo after having been bound by the hands and blind-folded. Prior to being removed from the ward room an English-speaking Korean Army officer assured me that my seriously wounded patient (FN WOELK) would be taken to a hospital for immediate surgical attention. This was not done and the crewman was subjected to an overnight train ride to Pyongyang (North Korean capital) without any medical attention. This could have easily resulted in his death if his wounds had started to bleed, allowing shock to advance further.

After arrival at the first place of detention in Pyongyang where the crew spent some six weeks, I immediately inquired concerning the condition of the wounded. I was informed by our captors that all the wounded were being cared for and was denied my request to visit them. It was not until sometime later that I learned that WOELK, the seriously injured crewman, had been in the same building as I, and had been moved to a hospital in Pyongyang for treatment. During this period of approximately six weeks in our first detention site it came to my attention that several members of the crew who had been wounded had received surgical treatment for the removal of shrapnel.

In addition I learned daily that some members of the crew were being treated for minor medical complaints by a North Korean Army doctor and nurse. These complaints consisted mainly of the U. R. I. syndrome, dermatitis of the feet and diarrhea. During the first few weeks of detention it was very evident that some of the crewmen were suffering from mental stress. Long hours of interrogation coupled with insufficient rest and diet, and brutality, in addition to anxiety concerning our fate as prisoners in a communist country, certainly took its toll among some of the crew. In the early part of March 1968 the crew was moved by bus some 10 miles from the city of Pyongyang to our second place of detention where we

remained until the day of our repatriation on 23 December 1968. The building itself was, by Korean standards, a modern three-story building. The PUEBLO crew occupied the top two levels. The first floor was occupied by North Koreans as living quarters and office spaces. The crew was accommodated in rooms, eight men to a room, with one of the rooms housing four crewmen. The officers were separated and lived in individual rooms, but were allowed to have their meals together, usually to join the enlisted men in calisthenics and sports periods, and often to play cards together in the evening hours. The daily routine and one that rarely varied during our captivity, began with reveille from 0500 to 0630 (depending on the season), followed by calisthenics outside the building for a period of about 15 minutes, washing of face and hands (approximately 10 minutes allowed for each room including a head call) and cleaning of individual rooms and passageway. Breakfast at approximately 0700 usually consisted of bread, butter, sugar, a watery potato soup, and boiled water. After eating we returned to our rooms in formation and were never allowed to leave except for head calls as authorized by the guards, or other individual or group activities as scheduled by our captors. We received one shave a week and a haircut every two weeks. This service at first was performed by a Korean barber, but later the duty was performed by our ships storekeeper, who was a former ships serviceman, and our two stewards. We were provided with a great quantity of Communist literature which we were expected to read. Once or twice a week a discussion was conducted by a senior North Korean officer (Major and above) usually having to do with the articles appearing in the magazines and newspapers provided. I was never led to believe that the crew was being brainwashed, but suspected that the officers in charge of the lectures and indoctrinations were extremely interested and hopeful that we would accept as the truth at least part of the propaganda that was given to us. After arrival at our permanent place of detention I was introduced to a North Korean Army Medical Officer with the rank of Light Major. Through an interpreter the doctor asked several questions concerning the health of the crew. I answered that prior to our capture the health of the crew was considered "excellent." The medical officer then informed me that he had been assigned by his government to care for the medical needs of the PUEBLO crew, and that anyone needing medical attention should report to him at daily sick call. I then requested if I could at least assist in holding sick call, but this was refused because of the language

barrier (although an interpreter was always present with the doctor), an Army nurse (female) who had been assigned to assist him, and my alleged lack of familiarity with Korean drugs or medical procedures used by Korean doctors. The most demoralizing part of the detention for myself was living with the fact that I was the Ships Medical Department Representative, but was not allowed to help care for and treat the crew medically. I also realized that I would be in part assuming responsibility for a patient's condition by offering any medical advice without any medication or any means of properly examining the patient. At least the Korean doctor had medicines and facilities for examining a patient. I recalled that during the Korean war a large majority of our Army Medical officers who were captured by North Korean and Chinese Communist forces were not allowed to treat the sick, but were often given routine orderly duties to perform.

At various times during the next several months I was allowed to care for some of the more acutely ill, including one severe case of infectious hepatitis with jaundice, and to perform routine orderly type duties. During the month of JULY 1968 the crew was informed that a two day physical examination would be conducted. This was going to be done, the North Koreans explained, because of some rumors in the United States that the PUEBLO crew were not receiving proper medical care. The physical examination was performed by a group of North Korean doctors and nurses and consisted of a chest X-ray; blood, urine, and stool tests; urological examination; eye check; and internal medicine exam. The various examinations conducted by the doctors were quite professional, but many of the crew who complained of medical problems to the doctors never received any type of medication or follow-up. A dental examination was also conducted but no treatment was rendered for the many dental problems. Several of the crew who had left their spectacles aboard ship were provided with eye glasses several weeks after the physical exam. The usual propaganda filming was carried on constantly during the entire physical examination and the treatment of the crew before, during, and immediately after the physical examination improved to the point where we could almost do no wrong. It would have been nice to think the examinations were conducted because our captors truly wished us to remain in good health. However after a complete review of the entire affair I can come to only one conclusion, that it was only one more link in the chain of propaganda that the North Korean government hoped to salvage from the PUEBLO in-

cident. The full-time Army Medical officer held sick call from 1100–1200, almost everyday except Sunday, and maintained living quarters on the first deck of the building. In all fairness, I believe this doctor tried to help us medically but he was greatly handicapped by the lack of diagnostic aids such as laboratory and X-ray studies. Some of his procedures were certainly lacking in technique acceptable to our modern standards of Navy Medicine. I know of at least two instances where the doctor interfered when he caught a guard mistreating the crew. It is also realized that the North Korean doctor had top orders from his government to keep us at least in a fair state of health because of the propaganda and filming involving most of the crew. The doctor was assisted by an Army nurse (enlisted) whom the crew had nicknamed "Little Iodine." This nurse seemed professionally competent, could give injections, including I. V.'s, and performed various other nursing chores satisfactorily. The dispensary itself consisted of one room on the second deck. It was equipped with the usual items found in a doctor's office (stethoscope, otoscope, scissors, forceps, gauze bandage, etc.). Two medicine cabinets contained various medicines, most of which had Korean letters on the labels, but some, especially penicillin and streptomycin, had Russian letters on the labels.

The following conditions were observed by me through direct consultation with the crewmen after they had attended sick call, or were brought directly to my attention.

1. 100% of the Pueblo crew experienced diarrhea and gastrointestinal upsets, with or without nausea and vomiting, at one time or another during the confinement.

2. 100% of the crew suffered some weight loss. This varied from 10 pounds to 100 pounds, although the entire crew subsisted on the same diet.

3. 100% of the crew contracted mild to serious upper respiratory infections and fevers of unknown origin which were usually treated conservatively with Aspirin.

4. Two crewmen acquired hepatitis as diagnosed by the North Korean doctor. One of these crewmen, seriously ill and very jaundiced, required constant treatment by the doctor and nurse, and observation by the Navy Corpsman. He received nutritious diet, intravenous solutions, vitamins and other unknown drugs, and responded well to this treatment. The PUEBLO Corpsman was allowed to initiate isolation procedures for this patient, after a lengthy discussion with the doctor. This included complete isolation in a separate room away from the crew, face masks,

washing of hands with disinfectant upon leaving and entering the room, changing of bed linen and underclothes at frequent intervals, AM and PM care, and frequent bathing. The patient's mess utensils were kept separate and sterilized with boiling water after use. Two more cases of hepatitis were diagnosed by Navy doctors upon the crew's return to San Diego Naval Hospital.

5. Approximately 20% of the crew developed some edema with pain in their legs, especially the ankles and feet, with tingling of the upper thighs.

6. Approximately 10% of the crew suffered some sort of urinary tract difficulty with frequency the biggest complaint. This usually cleared in about one week with a white powdered medicine as prescribed by the doctor.

7. Bronchitis or Bronchopneumonia. X-ray facilities were not available, except for the one chest X-ray taken in July 1968 during the physical exam. Perhaps 10–15% of the crew experienced acute illness with high fevers 102 F to 104 F (this is only an estimate) and complained of dry or productive cough, chest pain, and loss of appetite. Although their weight loss contributed greatly to their weakened condition, these patients responded to therapy administered by the doctor. Those with high fevers were allowed bed rest until the fever subsided, and were served meals in their rooms.

8. An immunization for Japanese encephalitis was administered by the doctor and nurse in June 1968. The needle was changed approximately every five men. An oral medication (white tablet) was dispensed twice a week prior to the noon meal for about 6 weeks during the summer months. It was explained to the Hospital Corpsman that this was prophylactic for malaria.

9. Sore tongue and cracked corners of the lips were common. One man had an acute dermatitis covering his entire body, which blistered. The skin became red and cracked especially on the hands, scrotum, and face. He was treated with various salves by the doctor (none worked) and obtained relief by soaking himself in luke warm water.

10. Skin Infections. At least 50% to 75% of the crew at one time or another suffered from boils, abscesses, infections surrounding the nails of the fingers, or common skin infections of the inner thighs, scrotum, and feet due to uncleanness. These conditions were treated with everything from minor surgical procedures, local solutions and ointments, to iodine for the rashes involving the feet and scrotum.

11. Dental Treatment. There was no dental treatment available except that which the North Korean

physician could administer. The doctor did tell me in November that he planned to contact a dentist to treat the dental problems within the "next few months."

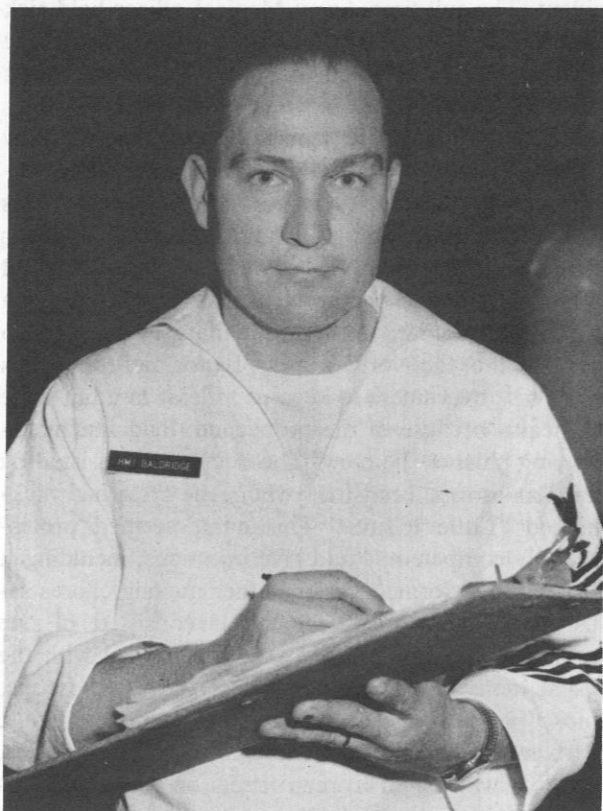
12. 100% of the crew, without a doubt, sustained bruises, facial lacerations, contusions, and abrasions resulting from mild to severe physical abuse. One crewman received a beating in December 1968 which resulted in a fractured mandible. Some injuries were sustained during athletics and consisted of sprained ankles, a fractured finger sustained by one crewman playing volleyball, and a fractured or dislocated patella as a result of a basketball accident.

13. A tonsillectomy was performed on one crewman during the confinement after several bouts of tonsillitis. This surgery was performed by a doctor who was called in by our regular medical officer.

14. Sanitation facilities especially with regard to the preparing and dispensing of food were certainly lacking. We constantly found flies, insects, dirt, and other foreign materials in our rice and soup. Our mess cooks who dispensed the food at meals kept as clean as they could, washed their aprons twice a week. Most of the time the mess gear could only be washed with cold water since soap and hot water were at a premium.

Conclusion. The statements and opinions that I have expressed here are based on my observations and findings after many months of careful thought and consideration. I have read about Army medical officers' experiences when captured during the Korean war by the Chinese and North Korean Communists. The problems and diseases which they reported are similar to the ones I have discussed in this article. It is sincerely hoped that the U.S. Navy Medical Department will find my report of some interest.

HM1 Herman P. Baldridge, USN, enlisted on May 18, 1950, at Kansas City, Mo. Following recruit training in San Diego, Calif., he completed studies at Hospital Corps School and subsequently served at the Naval Hospitals in Newport, R. I., Coco Solo in the Canal Zone, and Memphis, Tenn. During the Korean conflict he was assigned duties aboard the Light Aircraft Carrier, USS WRIGHT. He also served with the First Marine Air Wing at Atsugi, Japan, and the Third Marine Air Wing at El Toro, Calif. Subsequent tours of duty include the Marine Corps Recruit Depot in San Diego and Advanced



—Official U.S. Navy Photograph

Hospital Corps School at San Diego in 1964. In 1965 he was assigned to Patron 50 and served 2 tours of duty in Vietnam. From June 1967 to March 1969, HM1 Baldridge served as independent duty corpsman aboard the USS PUEBLO. Throughout the crew's captivity, subsequent hospitalization and the period of the court of inquiry, this Petty Officer's unwavering concern and medical support continued unabated and have been cited as evidence of his outstanding performance of duty in all respects. He is presently assigned to duty at the Fleet Activities Dispensary in Sasebo, Japan. HM1 Baldridge has been awarded the Navy Achievement Medal for superior performance of his duties from Dec 1968 to Jan 1969 as Medical Department Representative of USS PUEBLO, subsequent to the release of the crew from captivity in North Korea.

(We are grateful to RADM H. D. Warden, MC, USN, Commanding Officer of San Diego Naval Hospital, for initiating this report, and to CAPT H.A. Streit, MC, USN, Senior Medical Officer at Fleet Activities Station Dispensary in Sasebo, Japan, for his kind assistance.)

RESEARCH SECTION

INTERNATIONAL RESEARCH PSYCHOLOGY SYMPOSIUM HELD

The Sixth International Conference on Applied Military Psychology was held from 22-26 September 1969 at Leksand, Sweden. Chairman of the Symposium, CDR Newell H. Berry, MSC, USN, is currently Assistant for Development to the Director of the Research Division, BUMED. Participants came from Canada, Germany, Great Britain, Israel, the Netherlands, Norway, Sweden, Belgium, and the United States. The tradition of the Symposium holds that attendance be restricted to not more than two psychologists from each participating nation working full-time on in-service military psychology programs. Representing the United States were: LCDR Paul D. Nelson, MSC, USN, Program Manager for Human Effectiveness in the Research Division, BUMED; and Doctor Walter L. Wilkins, Scientific Director of the Naval Medical Neuropsychiatric Research Unit in San Diego, California.

Because the Symposium was designed to allow a maximum of discussion and free exchange of information, no papers were read; position papers, however, were circulated among the participants. The four general areas of discussion included: cooperative research in military psychology, attitude measurement, validation studies, and small group research.

The Symposium was sponsored by the Office of Naval Research, Branch Office, London, England.

BLOOD PRESERVATION MEETING IN MOSCOW

The XII Congress of the International Society of Blood Transfusion Meeting was held in Moscow, USSR, from 15 - 22 August 1969. Serving as Co-Chairman of the session on Long-Term Preservation of Blood Cells was CDR Robert Valeri, MC, USNR, Officer-in-Charge, Naval Blood Research Laboratory (NBRL), Chelsea, Massachusetts. CDR Valeri presented three papers, entitled: "Current Status of Freeze-Preservation of Human Red Cells with Glycerol," "The Effect of Chromium Elution on Red Cell Survival Measurements," and "Survival of ACD-Stored Red Cells during Extracorporeal Circulation." Over the past 2 years, NBRL has established methods for red cell washing and has pioneered the application of those procedures in clinical medicine.

On his return trip, CDR Valeri visited representa-

tives of the Italian Navy and Army and the University of Rome. New information obtained will contribute to the study of the function of red cells, which is so critical for the evaluation of optimum therapeutic effectiveness of preservation procedures.

COAGULATION STUDY PRESENTED

LCDR Ronald D. Miller, MC, USNR, presented two papers at the Annual Meeting of the American Society of Anesthesiologists in San Francisco. Attached to the U.S. Naval Medical Research Unit Number Two's DaNang Detachment, Doctor Miller discussed "Inhibition of Succinylcholine-Induced Increased Intragastric Pressure by Non-Depolarizing Muscle Relaxants." The second paper, "Coagulation Defects Associated with Massive Transfusions," was authored by Doctor Miller along with LCDR Thomas O. Robbins, MC, USN, and LT Myron J. Tong, MC, USNR. Their coagulation study was one of only a few papers selected for advance publicity for this meeting.

CAPT KINGSTON RECEIVES MEDAL

On 25 September 1969 VADM George M. Davis, MC, USN, Surgeon General of the Navy, presented CAPT James R. Kingston, MC, USN, with the Meritorious Service Medal for his "outstanding services as Assistant for Basic Research to the Director, Research Division, Bureau of Medicine and Surgery, from 9 November 1964 to 1 October 1969. He has established a vigorous Meningitis Research program and was instrumental in establishing the Neisseria Repository which will be receiving and typing Neisseria cultures and acute and convalescent sera on all Neisseria meningitis patients from all Navy laboratories and treatment facilities. Thus, studies of meningitis epidemiology, pathogenicity, immunity, serology, and genetics will be greatly enhanced." Attached to the Office of Naval Research as the Special Assistant for Medical and Allied Sciences with additional duty to BUMED, CAPT Kingston retired on 1 October 1969, but has been officially retained on active duty.

The 1967 recipient of the Gorgas Medal, CAPT Kingston has also been awarded the Legion of Merit for his identification of the Eaton Agent as the organism which is the principal cause of primary atypical pneumonia and for establishing an efficient treatment for that disease. One of his other accomplish-

ments directly benefiting the Navy is the development of an adenovirus vaccine to protect recruit populations from upper respiratory infections.

MEDAL FOR CDR UPCHURCH

CDR Ouida Catherine Upchurch, NC, USN, was presented the Meritorious Service Medal by CAPT Herschel C. Sudduth, MC, USN, Commanding Officer of the Naval Medical Research Institute (NMRI), Bethesda, Maryland. The medal was awarded to her "for exceptionally meritorious

achievement in the performance of outstanding services as Project Director of BUMED's Education and Training Development Project from October 1965 to July 1969. . . The concepts incorporated in this program represent the most significant advances in Navy medical education and training since World War II." At NMRI, CDR Upchurch is Deputy Director of the Education and Training Sciences Department and Chief of the Nursing Research Division. She also is assigned additional duty at BUMED as Assistant for Education and Training to the Director, Research Division.

NAVY PMU FIGHTS MALARIA

*U.S. Naval Support Activity, DaNang, FPO San Francisco,
News Release No. 264-69, Reported by SN Tim Lederle.*

DaNang (PAO) . . . Deft hands worked swiftly with the miniature scalpel. A drop of saline solution fell from a bottle overhead. Even under the powerful microscope each incision was flawless. Soon the salivary glands were removed.

Sounds like major surgery at a hospital in the United States? Not quite! In a Quonset Hut at the Station Hospital of the U.S. Naval Support Activity (NSA), DaNang, the Preventive Medicine Unit had completed dissecting one of thousands of mosquitoes it will study this year.

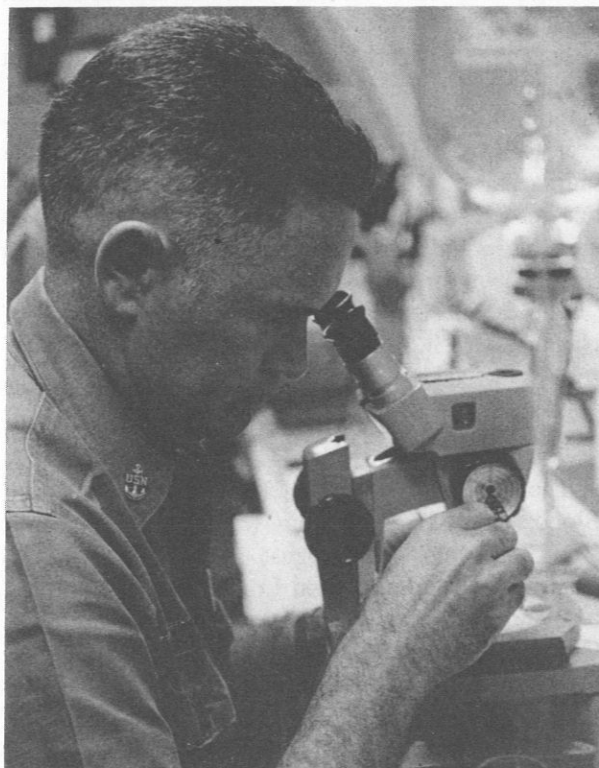
Part of the PMU research project on the major carriers of malaria, this skillful dissection, followed by a microscopic analysis, may prove the turning point in the battle against one of the most persistent diseases in Vietnam. In the last several years, there have been times when up to 80% of the hospital beds in Vietnam were filled by the victims of disease, not war, and the major disabler has been malaria.

One of the seven naval units in the world which specialize in disease carrier research, DaNang's PMU is unique because much of its research is performed under difficult, war-zone conditions. Other units work on different projects, but NSA's Preventive Medicine Unit has focused much of its effort on malaria carriers because of the magnitude of the disease in the Republic of Vietnam.

Commander W.F. Miner, Officer in Charge of the PMU, explained, "Since we had not, as a country, been exposed to malaria before we came to Vietnam, we had not expended the tremendous research time necessary to overcome it." The staff of six, doctors, entomologists (zoologists specializing in the study of insects), and highly trained laboratory technicians of

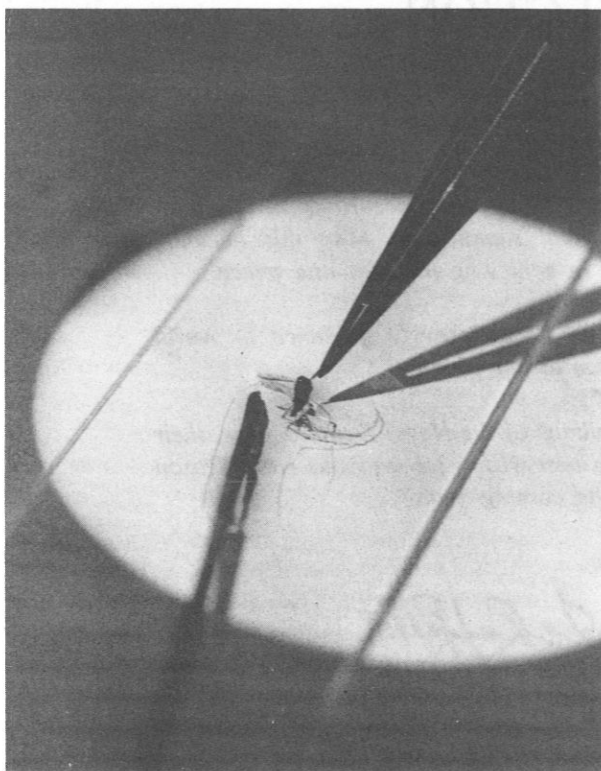
the PMU entomology team, are working hard to make up for lost time.

The only effective remedy is to eliminate the



Against Tremendous Odds—After dissection, the salivary glands and gullet of the mosquito are viewed at 800 times normal size to determine if the malaria parasites are present. "Carriers" are thought to be only one in 10,000, so the Preventive Medicine Unit can hope to find only four or five this year.—Official U.S. Navy Photograph by L. D. McLendon, PH1.

carrier mosquito before it has a chance to find its human prey. Because it is not known exactly which of the many types of mosquitoes are carriers of malaria in Vietnam the PMU presently operates an insecticide spraying program aimed at all types. This program can obtain only limited success because of the impossibility of destroying all mosquitoes in an area as huge as I Corps, the area for which DaNang's PMU is responsible (I Corps comprises the five northernmost provinces of the Republic of Vietnam).



Dissection—Suspended in a drop of saline solution, the mosquito must be flawlessly dissected if the salivary glands and gullet are to be removed intact. Although only the female *Anopheles* mosquitoes carry malaria, the Preventive Medicine Unit must determine which of the 25 known *Anopheles* are carriers in Vietnam.—Official U.S. Navy Photograph by L. D. McLendon, PH1.

Mosquitoes are most vulnerable to sprays during feeding times, and in the places where they breed. Because habits vary so greatly among different types of mosquitoes (one feeds at night and breeds exclusively in swamps, while another feeds only during daylight hours and breeds in tin cans), extermination of all types with a single, generalized program is not possible.

"Although other types carry yellow fever and different viruses, only the female *Anopheles* mosquito

transmits malaria." Lieutenant Roger H. Grothaus, director of the Entomology Laboratory, continued. "The question is, which of the 25 known *Anopheles* (and possibly some as yet unidentified) are carriers of malaria in this area?" Once this is determined, a spraying program many times more effective than the present one can be initiated by striking at the carriers when they are most vulnerable.

The PMU will identify over 300,000 mosquitoes this year. The female *Anopheles* will be separated and painstakingly dissected. Examination of the salivary glands and gullet (where the malaria parasites reside) under a microscope at 800 times normal size will expose the microscopic malaria parasites if they are present. Once enough *Anopheles* mosquitoes carrying malaria are found, it will be established which of them are the carriers, and thus which are to be eliminated.

How many mosquitoes will the PMU dissect before it can identify the malaria carriers? "Since the number of mosquitoes carrying malaria is thought to be as low as one in 10,000, we can hope to find only four or five carriers this year." Lieutenant Roger S. Stasiak, PMU entomologist, concluded: "However finding that many carriers of one type will be significant."

These are tremendous odds to work against, but the PMU will save many lives and literally thousands of man hours a week, both American and Vietnamese, if it determines which of the *Anopheles* are the major carriers of malaria.

NSA's entomologists and Preventive Medicine technicians are highly trained in Navy PMU work. With the average educational level approaching a Master's degree in entomology, they are qualified to work under exacting laboratory conditions. Yet in Vietnam they often find themselves called upon to apply their knowledge in the even more demanding "outdoor laboratory" of the war-zone.

One of the identification procedures requires PMU members to sit up late into the night in areas where malaria is prevalent, and allow mosquitoes to land on them. By capturing and identifying these mosquitoes, the PMU can determine which types are man-biters in the area, and thus which are most likely to be malaria carriers.

Live trapping is accomplished by "baiting" traps with dry ice flown in from Taipei, Formosa. Dry ice gives off carbon dioxide as it melts, and the mosquitoes are drawn to the trap believing it is the

carbon dioxide in a man's breath. Traps drawing mosquitoes to light bulbs are used at facilities where electricity is available. Operating traps in areas where malaria is most common increases the chance of finding carriers.

Two team members of the PMU reactionary force, which goes into the field to collect mosquitoes in areas of high malarial rate, have contracted malaria

as a result of their increased exposure, and most of the men have been sniped at while collecting.

As one member of the PMU candidly stated, "Our hours here are long, hard, and sometimes dangerous; and we are rarely rewarded with a positive result from our efforts. But we look forward to making a decisive step in controlling malaria, and that will be compensation enough."

DENTAL SECTION

PERSONNEL AND PROFESSIONAL NOTES

Christmas Greetings

With the advent of the Christmas Season, let each of us according to our individual faiths, pause and reflect on its spiritual significance. May this meaning permeate all mankind and act as a catalyst in achieving freedom and peace.

In His divine wisdom, may the Prince of Peace provide guidance to world leaders and bring to fruition a world at peace in our lifetime.

To the officers, enlisted personnel and civilians of the Naval Dental Corps, their families and loved ones, I send greetings and best wishes for a joyous Holy Season and for health and happiness throughout the coming year.

Merry Christmas and a Happy New Year.



E. C. RAFFETTO
Rear Admiral, DC, USN
Assistant Chief of the Bureau of
Medicine and Surgery (Dentistry)
and Chief, Dental Division

LONG COURSES AT CIVILIAN UNIVERSITIES

The Dental Training Committee convened in the Bureau of Medicine and Surgery in September to select dental officers for long courses of instruction at civilian universities in Fiscal Year 1971. Twenty-one dental officers were selected and approved to begin training and 16 were recommended and approved for continuation of training.

NEW MOBILE DENTAL UNIT FOR VIETNAM

A second completely mobile dental facility has been placed in use in Vietnam to provide treatment

for personnel in the III Corps area. A similar unit has been in use in the DaNang area since May 1969.

The unit, which features modern equipment as well as air conditioning, can be lifted by a helicopter or pulled by a vehicle. The mobility of the unit will enable the dental personnel to provide treatment to patients who would otherwise have to travel to DaNang for care.

WEARING OF THE UNIFORM

BUPERSNOTICE 1020 is published as an advance change to *U.S. Navy Uniform Regulations*, and sets forth, in part, the following information:

The wearing of the uniform with pride sets the Navyman apart from his civilian contemporaries and shows the civilian community that here is a man who serves his country, often at personal sacrifice. All members of the Navy are strongly encouraged to wear the uniform, not only while in a duty status, but also while on leave or liberty when engaged in activities which bring credit to the service and are in keeping with the dignity of the uniform. However, the uniform must not be worn to borrow its inherent dignity to lend weight and significance to privately held convictions or public issues.

Accordingly, the wearing of the uniform is prohibited under the following circumstances:

1. In connection with political activities.
2. In connection with private employment or commercial interests.
3. While participating in marches, rallies or any public demonstrations unless sanctioned by competent Service authority.
4. At any meeting sponsored by totalitarian, fascist or communist organizations so designated by the Attorney General of the United States.

PROFESSIONAL RELATIONS PROGRAM

ADMIRAL SCHADE SPEAKS BEFORE NAVAL RESERVE DENTAL SYMPOSIUM

The program in the scientific Session Lectures of the Naval Reserve Dental Symposium at the joint meeting of the 110th Annual Session of the American Dental Association and the 57th Annual Session of the Federation Dentaire Internationale, held in October at the New York Coliseum, New York, included the following speakers.

"Welcome"

RADM Francis D. Foley, USN
Commandant, Third Naval District

"Naval Dental Corps—1969"

RADM Edward C. Raffetto, DC, USN
Assistant Chief of the Bureau of Medicine and Surgery (Dentistry) and Chief, Dental Division

"The Silent Service"

VADM Arnold F. Schade, USN
Commander Submarine Force
United States Atlantic Fleet

"Dental Services for Undersea Personnel"

CDR William R. Shiller, DC, USN
Naval Submarine Base New London

5. While delivering public speeches or participating in interviews not sanctioned by competent Service authority.

6. When wearing of the uniform would tend to bring discredit upon the Armed Forces.

NAVY PERIODONTAL SCREENING EXAMINATION

The forms for the Navy Periodontal Disease Index NAVMED 6600/1 and the Navy Plaque Index 6600/2 may be requisitioned as stated in BUMED letter 6115-bmm 6600 of 12 May 1969. Some delay in receipt of the above forms has been reported in requisitioning through normal supply channels. In the future, it is recommended that subject forms be procured directly from one of the following primary stock points:

- (1) Naval Supply Center, Norfolk, Virginia
- (2) Naval Supply Center, Charleston, South Carolina
- (3) Naval Supply Depot, Newport, Rhode Island
- (4) Naval Supply Center, San Diego, California
- (5) Naval Supply Center, Oakland, California

The moderator for the symposium was CAPT Robert F. Tuck, DC, USNR, Head, Reserve Branch, Bureau of Medicine and Surgery.

AMERICAN COLLEGE OF DENTISTS

Fellowships in the American College of Dentists were conferred upon two active duty naval dental officers and one retired naval dental officer during the 49th Annual Session of the American College of Dentists at the Waldorf-Astoria Hotel, New York City.

The new fellows are:

CAPT Julian J. Thomas, DC, USN
CDR Bill C. Terry, DC, USN
CAPT Clyde R. Parks, DC, USN (Retired)

INTERNATIONAL COLLEGE OF DENTISTS

A fellowship in the International College of Dentists was conferred upon CDR Jefferson F. Hardin, DC, USN, during the Annual Session of the International College of Dentists at the Americana Hotel, New York City.

PEOPLE TO PEOPLE—MALTA

The members of the Malta Dental Association and dental students of the Royal University recently attended a dental seminar at the Medical School, Guardamangia, organized by the dental officers of the Destroyer Tender, USS YOSEMITE (AD-19) and the Dental Surgery faculty of the Royal University of

Malta. The program consisted of short table clinics presented by LT James Valace on "X-Tension Cone-parallel Technique in Periapical Radiography," LT Kevin L. McBride on "Naso-Palatine Duct Cysts Pathogenesis and Treatment," and LT Robert S. Baycar on "Posterior Palatal Seal." CDR Leonard E. Mark gave a lecture on the "History of Articulators."

ARTICLES AND ABSTRACTS

THE MANAGEMENT OF TEETH RELATED TO THE TREATMENT OF ORAL CANCER

J. R. Hayward, DDS, D. A. Kerr, DDS MS, R. H. Jesse, MD, S. G. Castigliano, MD, I. Lampe, MD and J. I. Ingle, DDS, CA 19: 98-106, Mar-Apr 1969.

Routine removal of all teeth is no longer justified when radiation therapy is required for oral cancer. Improved radiation techniques have reduced the incidence of osteoradionecrosis after oral cancer treatment to 2%. The reduction in damage to bone and soft tissue is the result of the use of cobalt and other supervoltage irradiation techniques. Caries following radiation is now generally thought to be the result of changes in the saliva, diet, and oral hygiene habits of the patient and not the direct effect of radiation upon the teeth. Dentin defects occur regardless of whether the teeth are in or out of the field of radiation. When the salivary glands are irradiated the pH of the saliva drops to about four and the volume of saliva is greatly diminished (xerostomia). Mucositis also results producing a very tender mucosa thus limiting the patient to a diet of soft foods high in carbohydrates. Mucositis also limits oral hygiene procedures because of the mechanical irritation of brushing and the chemical irritation of a dentifrice. A viscous acid plaque develops during this phase of mucositis and xerostomia, and the immediate result is a tremendous increase in caries activity.

The dental treatment plan for the oral cancer patient should be based on the following factors:

1. Patient's oral hygiene and oral consciousness—a much greater effort will be required to maintain oral hygiene under the adverse conditions of severe mucositis and xerostomia which follows irradiation.
2. His susceptibility to caries—patients with high pre-radiation caries activity are more vulnerable to

caries activity resulting from radiation changes.

3. The amount of gingival recession—exposed root surfaces are highly vulnerable to caries, and this potential for cervical caries is classical following irradiation.

The dentist should evaluate the condition of the teeth and associated tissues and should conduct a careful dental examination. A decision for the removal of teeth should be made only after consultation with the endodontist and the periodontist.

After radiotherapy, dental caries with involvement of pulp should be treated endodontically rather than by extraction. Grossly hypermobile teeth may be allowed to exfoliate.

A careful oral hygiene program should be outlined for the patient and followed scrupulously before, during, and after therapy for the rest of the patient's life. The pretherapy program consists of the elimination of all caries and periodontal disease as far as possible. Topical application of 2% sodium fluoride should be administered as part of the polishing procedure during the postextraction healing period and through the first two weeks of irradiation therapy. When therapy is started the patient should be taught home care procedures consisting of (1) brushing, (2) oral lavage, and (3) topical fluoride gel application. Patients should be taught a simple but effective method of brushing with a soft brush four times a day—after each meal and before retiring. This is followed by oral lavage which consists of flowing one quart of alkaline saline through the oral cavity under mild pressure. Lavage should follow each brushing, but may be used with greater frequency as needed for relief of the symptoms of mucositis and xerostomia. During the height of the radiation reaction patients gain more relief from oral discomfort through this procedure than any other means. Oral lavage is accomplished by adding one teaspoon of baking soda and one half teaspoon of salt to one quart of water that is as warm as the patient can comfortably tolerate. The warm alkaline

The opinions and assertions contained herein are those of the authors and are not to be construed as reflecting the views of the Navy Department or the naval service at large.

saline solution is placed in a disposable unit which has been fitted with an applicator tip having a 2 mm aperture. The unit is suspended four to five feet above a sink or bowl into which the quart of fluid can be drained after it has been flowed over the oral tissues. Stronger jet pressure devices may be painful and hazardous to the inflamed mouth. Daily topical fluoride gel applications should start when the patient begins radiation therapy. The fluoride gel application consists of a plastic carrier constructed for each individual dental arch with fluoride gel placed in the carrier and the carrier placed over the teeth for five minutes. If the patient has xerostomia for a prolonged period it is especially important that he follow this brushing, lavage, and fluoride application daily for the rest of his life.

(Abstracted by: CDR Tennyson J. Lommel, DC, USN.)

MICROBIAL CONTAMINATION IN DENTAL UNIT WARM WATER SYSTEMS

G. B. Pelleu, Jr. and L. W. Wachtel.

Aerosols can be created and disseminated by high speed rotary instruments using water from the warm water system of dental units. If these aerosols contain appreciable quantities of microorganisms, this may introduce a danger of airborne infection into the dental operating room. The purpose of this study was to determine the presence of microbial contamination in dental unit warm water systems and to ascertain the level, extent, and persistence of this contamination. The warm water systems of 44 dental units at three naval facilities and one U.S. Public Health Service facility were sampled and tested for the presence of microorganisms. All were found to be contaminated with $10^{3.6}$ or more colony-forming units (cfu) per ml, with a mean recovery of $10^{5.8}$ cfu per ml. These microorganisms were essentially flavobacteria, pseudomonas, and other gram-negative bacilli. Flushing water through the drinking cup warm water dispenser, air turbine handpiece line, and warm water syringe of each unit for 2 minutes at approximately 1,500 ml per minute reduced the concentration of microorganisms to less than 10 cfu per ml in most units. Persistently contaminated units required flushing times up to 30 minutes. It was concluded that the warm water system of dental units is a focal source of microbial contamination and that until effective sterilization procedures are developed all dental units should be flushed for at least 2 minutes prior to daily use. The microbial concentrations

in the water of four dental facilities are shown in the table below.

Microbial concentrations in dental unit water systems at different facilities

Facility	Number of Dental Units	Microbial Concentration* cfu/ml
A	18	$10^{5.9}$ ($10^{3.6}$ — $10^{7.4}$)†
B	12	$10^{5.5}$ ($10^{4.5}$ — $10^{7.2}$)†
C	7	$10^{6.3}$ ($10^{3.9}$ — $10^{6.9}$)†
D	7	$10^{5.7}$ ($10^{4.5}$ — $10^{6.8}$)†
	Mean	$10^{5.8}$

* Samples taken from a'r turbine handpiece lines.
† Range.

(Abstracted by Research Work Unit: MR005.19-6051 by G. B. Pelleu, Jr. and L. W. Wachtel.)

IN VITRO STUDY OF RETENTIVE QUALITIES OF PINS IN DENTIN VS. IVORINE

*LCDR G. J. Walkowiak, DC, USN and
LCDR B. M. Mason, DC, USN.*

Numerous studies have been reported concerning the optimal number, depth, and angle of pins to use for amalgam retention. Both dentin and Ivorine had been used in such studies, but no comparison of these materials had heretofore been made with regard to pin retention. The purpose of this study was to compare the retention of different types of pins in dentin and Ivorine. Retention of Markley cemented, Unitek friction-locked, and self-threading Threadmate Minim pins was compared in both substances at depths of 2 and 4 mm. A porcelain facing drill was used to drill the various pinholes with a single pass to a micrometrically calibrated depth. Only the 4 mm Unitek hole in dentin was drilled with a standard slow-speed handpiece. Ivorine blocks, 12 by 12 by 40 mm, had hollows 7 mm in diameter and 8 mm deep drilled into one end to approximate the dimensions of dentin in a natural tooth. This surface was then finished so that it was perfectly horizontal. Dentin samples obtained from impacted third molars were finished in a like manner. The specimens were secured in a bench vise, with the pins down, and a clamp was used to grip each pin. A container attached to the clamp was filled with water until the pin separated, and the weight was recorded as force-pounds. A total of 262 pins of the three types were tested in this manner. Results showed that with the Unitek pins retention in dentin was equal to or better than in Ivorine, but with the Markley cemented pins retention in Ivorine was better than in dentin. In both cases, pins at 2 mm separated at 9 to 15

pounds. Pins at 4 mm were twice as retentive as at 2 mm. At more than 50 pounds, the Threadmate Minim pins fractured before separation from either material. It was concluded that the differences observed between dentin and Ivorine would not be clinically meaningful, and that pin retention in Ivorine is comparable to retention in dentin.

(Abstract by Research Work Unit: MR005.19-6052 by LCDR G. J. Walkowiak, DC, USN and LCDR B. M. Mason, DC, USN.)

FUNCTIONAL REGENERATION OF THE FACIAL NERVE IN DOGS UTILIZING MILLIPORE FILTER TUBES

*LCDR A. D. Loizeaux, DC, USN and
LCDR R. B. Maw, DC, USN.*

Histologic evidence had previously been presented that nerve tissues can be induced to span gaps when they are protected by tubes made of Millipore filter material. However, functional regeneration had not been demonstrated. The purpose of this study was to determine whether a branch of the facial nerve of dogs would regenerate and function across an artificially created gap when it was protected by a Milli-

pore filter tube. Nine dogs were used, with each animal serving as its own control. Right and left facial nerves were exposed and sectioned. A 2 cm gap was maintained by passing a sling suture between the nerve stumps on each side. A Millipore filter tube encased the nerve stumps and sling suture on the experimental side only. The animals were sacrificed at varying intervals from 6 to 23 weeks, and specimens were taken for histologic study. Just prior to sacrifice, the animals were tested for functional regeneration by isolating the nerve, stimulating it with an electrode, and noting any muscular contraction. Six animals showed histologic evidence of nerve regeneration on the experimental side in 6 to 16 weeks but no functional regeneration. The remaining three animals showed functional regeneration in addition to histologic regeneration on the experimental side after 18 to 23 weeks. No histologic or functional regeneration was observed where no Millipore filter tubes were used. It was concluded that Millipore filter tubes may be used successfully in nerve repair where end-to-end anastomosis is not feasible.

(Abstract by Research Work Unit: MR005.19-6052 by LCDR A. D. Loizeaux, DC, USN and LCDR R. B. Maw, DC, USN.)

ONE MILLION PATIENTS FOR AMPHIBIOUS FORCE MEDICS

*Commander Amphibious Force United States Pacific Fleet, San Diego, Calif.,
News Release No. 107-69, Reported by JO2 Bill Bartkus, USN.*

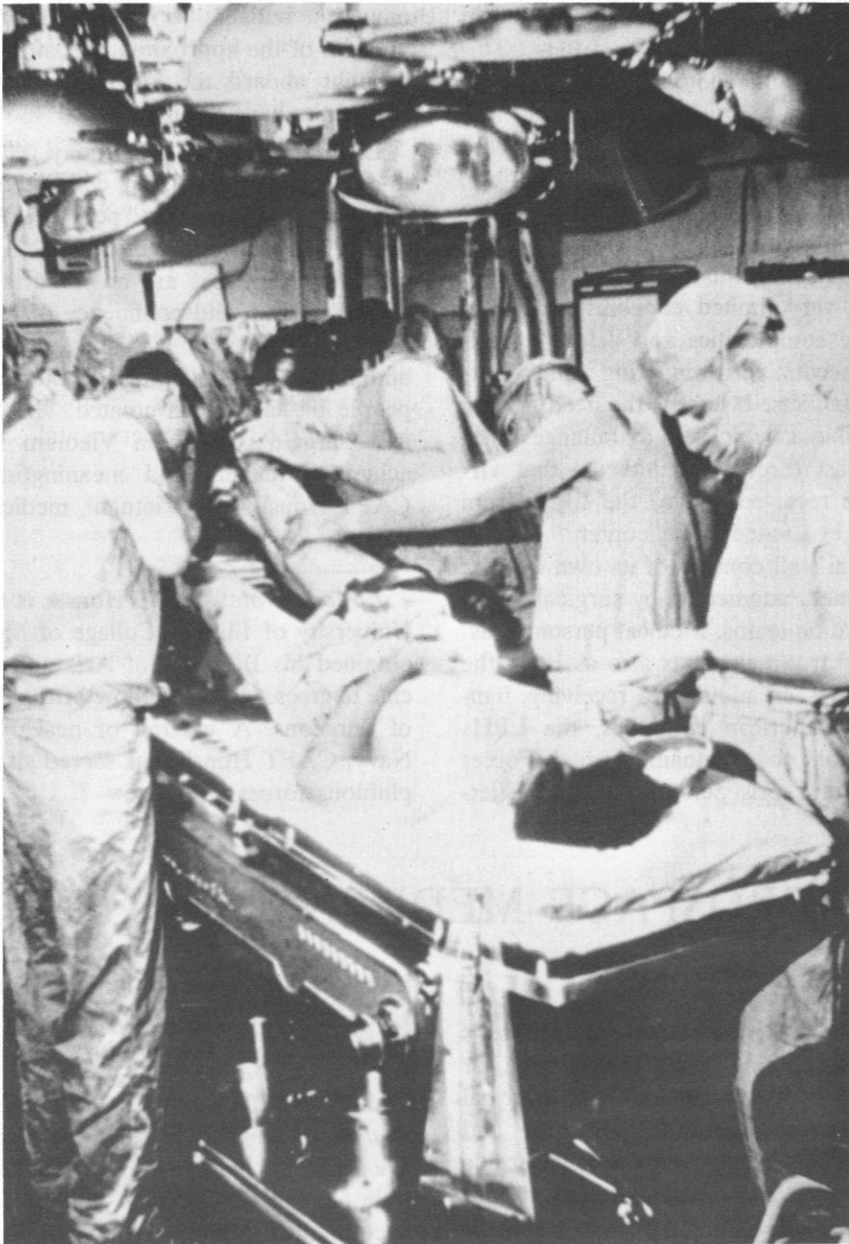
To some people, the number "one million" may be just another round figure. But if the word "patients" is added to one million, then you've got a figure that talks.

"In the last three and a half years, Medical personnel in the Pacific Fleet Amphibious Force have seen and treated approximately one million patients," according to Captain Cyril J. Honsik, the Force Medical Officer for Commander, Pacific Fleet Amphibious Force. This figure includes both civilian and military, friendly forces and prisoners-of-war.

CAPT Honsik stated that off the shore of the Republic of Vietnam, Amphibious Force Medical Personnel have treated approximately ten thousand casualties aboard amphibious assault ships (LPHs) in the last three and a half years. The number of surgical operations performed greatly exceeds the number of persons injured, because many of the casualties require multiple operative procedures.

"The weakest link in the chain of care for combat injuries or trauma of servicemen on the battlefield,"

said the doctor, "is that uncertain interval of time lapse between the injury and receipt of definitive care in the operating room or the intensive care unit." The medical officer commented that we must accept more responsibility for what goes on in this "twilight period," lasting several hours in past wars, if we hope to diminish the death rate. During World War II, it sometimes took as long as three days to get a seriously wounded serviceman to an adequate facility, staffed with appropriate medical personnel. Within the amphibious force, in Vietnam, the seriously wounded receive necessary treatment in a matter of minutes. CAPT Honsik feels that the best way to resolve this twilight period is to eliminate it through direct transport of the seriously wounded casualty from the battlefield directly to the operating room, resuscitative area or intensive care unit. This is known in the Amphibious Force of U.S. Pacific Fleet as the "one litter stop." The physician stated that the marked reduction in the ratio of "killed in action" versus "wounded in action" and returned to duty,



Floating Hospital—Doctors and hospital corpsmen aboard an amphibious assault ship off the coast of Vietnam perform surgery on a wounded man.—
(Official U.S. Navy Photograph.)

suggests that the doctrine of “seconds save lives” is an important one. It should also be noted, said the doctor, “that a great number of people have not suffered permanent disabilities as a result of this prompt and effective treatment. In addition, postoperative complications have been reduced to an almost absolute minimum.”

An LPH is a complete floating military base in an amphibious operation and hence is at the scene at the time casualties occur. LPHs operate within easy heli-

copter range of the beach making them accessible and speeding up evacuation of casualties to their medical treatment facilities. The medical spaces of these ships are designed to treat a large number of casualties. Treatment consists of everything from major chest and abdominal surgery to tropical disease.

The LPH uses its helicopters to carry troops and supplies in assaults on enemy positions. Having discharged their troops and cargo, the helicopters are

then used to evacuate casualties from the battlefield to the medical facilities aboard the LPHs. This system achieves maximum economy of forces and equipment which is a necessity for a successful amphibious assault operation. In addition there are helicopters assigned to medical evacuation standby duty, to handle cases occurring at times or in places where other helicopters are not available. This direct process reduces reliance on the infantry battalion aid stations with their very limited capabilities. It also greatly reduces the complexities and delays experienced with past procedures for rendering initial treatment in previous conflicts. It lessens the need for use of boats and amphibious vehicles in ambulance work. Records for the past three years indicate that virtually all casualties received aboard the LPHs from the battlefield were evacuated by helicopter.

The LPH medical staff consists of its own doctors and hospital corpsmen, augmented by surgical teams and casualty evacuation teams. Medical personnel assigned to embarked troop elements also assist in the treatment of casualties. In addition to receiving, handling and treating American casualties, the LPHs have treated Republic of Vietnam Armed Forces personnel, Viet Cong prisoners-of-war and Viet-

namese civilians as well. According to CAPT Honsik, of the approximately ten thousand casualties brought aboard the LPH alive, about only .01% mortalities have occurred.

LPH medical facilities today reflect the most up-to-date advancements in combat medicine. As the naval surgeon puts it, "people still count and are needed to win wars." Excellent medical facilities in their floating bases are an important factor in sustaining morale and confidence of assault troops and their loved ones. A lasting impression of friendship and regard in the minds of the South Vietnamese people has also been created. "Medicine is the biggest bargain counter in Vietnam in our efforts to achieve a lasting and meaningful peace," claims CAPT Honsik. "In Vietnam, medicine is one of our greatest 'weapons'."

Editor's Note: CAPT Honsik is a graduate of the University of Illinois' College of Medicine where he obtained his Bachelor of Arts and Doctor of Medicine degrees. He is a Fellow of the American College of Surgeons. A veteran of nearly 29 years in the Navy, CAPT Honsik has served six years in the amphibious forces.

AEROSPACE MEDICINE SECTION

THE CODE FIVE CORNER

This section of the *Aerospace Medicine Section* is established on a continuing basis to provide our people in the field with a "hot-line" for informal communication with the Bureau of Medicine and Surgery. The Code 5 team represents a considerable aggregate of experience and talent in the aerospace medicine field and CAPT Jahnke wishes to stress the role of the *Aerospace Medicine Code of the Bureau of Medicine and Surgery* in providing assistance and support to the flight surgeons, aviation physiologists and aviation psychologists in the field. We are here to help and guide you in approaches to problem areas. Do not hesitate to contact appropriate personnel for service. This communication effort is a two-way operation, however, and is only as effective as both ends of the system will try to make it. We depend upon your inputs, so let us hear from you continuously, please.

WHO'S WHO IN CODE FIVE

We thought it might be useful to present a brief

résumé of the organizational staffing of *The Aerospace Medicine Code of the Bureau of Medicine and Surgery* and its relationship within the Bureau.

Code 5—CAPT Leonard P. Jahnke, MC, USN the Assistant Chief for Aerospace Medicine, is one of the five assistant chiefs to the Surgeon General, is responsible for the development and projections of aerospace medical policies, standards, and practices, and advises the Chief of the Bureau on all phases of aerospace medicine. He directs programs related to physical qualifications, selection and training of aviation personnel; the aerospace medicine aspects of warfare systems, aircrew and aircraft safety and equipment. He also acts as Senior Member of the Board of Flight Surgeons and coordinates Medical Department aerospace medical programs within the *Bureau of Medicine and Surgery*, with other Navy bureaus and offices, other government agencies, civilian organizations, and foreign governments.

Address: Assistant Chief for Aerospace Medicine
(Code 5)
Bureau of Medicine and Surgery

Department of the Navy
Washington, D.C. 20390

Autovon: 22-62511

Code 51—CAPT Robert C. McDonough, MC, USN is Director of the *Aerospace Medicine Operations Division* and acts as your friendly detailee. He evaluates and advises on aerospace medical needs, policies, standards, practices and procedures, and administers aerospace medical programs relating to physical qualifications, training, selection and aeromedical personnel management. Questions on billets and training in Aerospace Medicine should be referred to this office:

Address: Director, Aerospace Medicine
Operations Division (Code 51)
Bureau of Medicine and Surgery
Department of the Navy
Washington, D.C. 20390

Autovon: 22-62826

Code 511—CAPT Joseph H. Britton, MC, USN is Head of the *Aerospace Physical Qualifications Branch*. He is responsible for the determination of physical requirements for air and certain ground crew personnel of naval aviation and reviews the reports of physical examinations of naval aviation personnel. Any questions dealing with physical fitness and aeronautical adaptability should be handled by this office:

Address: Bureau of Medicine and Surgery
(Code 511)
Department of the Navy
Washington, D.C. 20390

Autovon: 22-65378

Code 512—CAPT Mary F. Keener, MSC, USN is Head of the *Aerospace Physiology Training Branch*. She plans and directs the Aerospace Physiology Training Program for naval aviation personnel and monitors operating procedures for low pressure chambers, night vision trainers, ejection seat trainers and other physiological training units and devices. She also establishes requirements for training films and manuals within this field and makes recommendations to BUPERS on billet assignments for Aviation Psychologists, Aviation Physiologists, Aviation Physiology Technicians, Aviation Medicine Technicians, Parachute Riggers and Training Devicemen.

Address: Bureau of Medicine and Surgery
(Code 512)
Department of the Navy
Washington, D.C. 20390

Autovon: 22-64404

Code 513—LCDR James E. Goodson, MSC, USN is Head of the *Aerospace Operational Psychology Branch*. He is responsible for the psychological requirements for naval flight personnel and the processing of naval aviation selection tests. He monitors the training and assignment of Aviation Experimental Psychologists and maintains liaison with the Office of the *Chief of Naval Research* and the *Chief of Naval Operations* concerning human factors engineering.

Address: Bureau of Medicine and Surgery
(Code 513)
Department of the Navy
Washington, D.C. 20390

Autovon: 22-65062

Code 514—CAPT Henry S. Trostle, MC, USN is Head of the *Aerospace Medicine Special Activities Branch*. He develops and supervises the production of aerospace training manuals and audiovisual aids and is responsible for the production of aeromedical exhibits required for recruiting and symposia.

Address: Bureau of Medicine and Surgery
(Code 514)
Department of the Navy
Washington, D.C. 20390

Autovon: 22-63591

Code 52—CAPT Roger G. Ireland, MC, USN, is Director of the *Aerospace Medicine Technical Division* and also Head of the *Aerospace Medicine Systems Requirements Branch* (Code 521). He also has additional duty to the *Deputy Chief of Naval Operations (AIR)* in the Plans and Requirements Division and to ACNO (Safety) as senior Aeromedical Advisor. He evaluates and provides technical biomedical and bioengineering data on those aspects of aerospace medical programs pertaining to weapons systems requirements, aircraft and space vehicle crews and equipment, aerospace ground support, and aviation safety. He serves in a liaison capacity for the *Chief Bureau of Medicine and Surgery* with NASA's Manned Space Flight Program for Navy medical personnel participation in the recovery forces operations. He also reviews proposed medical spaces and outfitting allowances for aircraft carriers and makes recommendations pertaining to medical space arrangements, equipment, and supplies for such vessels.

Address: Director, Aerospace Medicine
Technical Division (Code 52)
Bureau of Medicine and Surgery

Department of the Navy
Washington, D.C. 20390

Autovon: 22-65542

Code 5211—CDR Paul W. Scrimshaw, MSC, USN is Head of the *Aerospace Physiology Systems Requirements Section*. He establishes requirements for low pressure chambers, ejection seat trainers, night vision trainers and other trainer devices used in support of the Aerospace Physiology Training Program. He is responsible for the safety and reliability of the devices and reviews and comments on requests for modifications to the equipment. He also makes recommendations on the allocation and disposition of surplus physiological training aids and devices, and monitors logistic support, device specifications, and design of buildings utilized for physiological training.

Address: Bureau of Medicine and Surgery
(Code 5211)

Department of the Navy
Washington, D.C. 20390

Autovon: 22-64404

Code 522—CDR Robert E. Kinneman, Jr., MC, USN is the Head of the *Aerospace Medicine Equipment Branch* on an additional duty basis from the *Crew Systems Division* of the *Naval Air Systems Command*. He advises and assists the *Air Systems Command* on research, development, test, and evaluation of aerospace crew personal equipment and provides technical and professional guidance on projects and contracts for the development of aerospace crew equipment. New ideas or recommended changes for existing equipment should be referred to this office:

Address: Bureau of Medicine and Surgery
(Code 522)

Department of the Navy
Washington, D.C. 20390

Autovon: 22-65034

Code 5221—LT Paul A. Furr, MSC, USN is Head of the *Aerospace Medicine Equipment and Requirements Section*. He assists Code 522 in his responsibility to the Director of the *Crew Systems Division* in research, development, test and evaluation in the area of human factors and life sciences technology. The responsibility for the Hearing Conservation Program formerly held by this Code has been transferred to the *Occupational Health Division* (BUMED Code 73) under the *Assistant Chief for Research and Military Medical Specialties*. Problems dealing with psychophysiological factors and tolerances in the field of aerospace crew personal equipment should be referred to this section:

Address: Bureau of Medicine and Surgery
(Code 5221)

Department of the Navy
Washington, D.C. 20390

Autovon: 22-65034

Code 523—CAPT Henry S. Trostle, MC, USN is also Head of the *Aerospace Medicine Flight Safety Branch* with additional duty to the *Deputy Chief of Naval Operations* (AIR) in Aeromedical Safety. He provides technical aeromedical advice in matters of aerospace medicine and training as they pertain to safety, and maintains direct liaison with the Naval Safety Center. He monitors Navy participation in the *Department of Defense* program of aviation pathology and assists in the study and development of psychophysiological operational requirements and development characteristics for support and equipping of aircrews.

Address: Bureau of Medicine and Surgery
(Code 523)

Department of the Navy
Washington, D.C. 20390

Autovon: 22-63591

NEWS OF PERSONNEL

Fourteen flight surgeons and aerospace experimental psychologists were recently selected for promotion. Congratulations are extended from Code 5 with pardonable pride.

PRESCRIPTION SUNGLASSES FOR FLIGHT-LINE AND FLIGHT-DECK CREWMEMBERS

It is possible to obtain prescription tinted lenses for flight-line and flight-deck crewmen under BUMED INSTRUCTION 6810.4D, providing adequate justification is given under "Details" on the Spectacle Order form (DD-771). The lenses *must* be prescription lenses; the form must be signed by the prescribing officer and signed and approved by the commanding officer of a medical command, or the senior medical officer of other medical facilities, or the senior medical department representative of other ships or stations. The request must be sent to and approved by the Commanding Officer, Naval Ophthalmic Support and Training Activity, Williamsburg, Virginia 23185. The spectacles issued will not be the "Smiling Jack" aviator type as provided for flying crew members nor will plano tinted lenses be issued; they will have 31% transmission neutral grey lenses mounted in the standard grey plastic frames.

SOUND SPECTROGRAPH ACQUIRED BY ACOUSTICS LABORATORY

A Voiceprint Laboratories Sound Spectrograph (Model 4691C) has been acquired by the Acoustics Laboratory, NAMI, as part of its basic instrumentation. The electronic instrument, which produces a permanent spectrum display of complex signals, will be used to analyze various types of acoustic signals (speech, sonar noises, heart sounds, etc.) and to determine possible patterns for identification and authentication. The sound spectrograph will also be used to conduct studies in the areas of talker recognition and the effects of different kinds of stress on speech.—Aerospace Medical Institute.

FURTHER DATA BEING OBTAINED ON NAVAL AVIATORS' SPEECH DISCRIMINATION TEST (NASDT)

Data continue to be gathered relative to the NASDT. In-flight test data are being obtained to validate the results of laboratory tests, and data are being obtained on a new test currently being studied by CHABA Working Group 52 ("Testing of Speech Reception of Aviators"). The Acoustics Laboratory, NAMI, was selected by CHABA WG-52 as one of several laboratories to investigate the new test.—AeroMed, BuMed.

NEWS OF MEETINGS

The Eighth Annual Meeting of Naval Aerospace Physiologists, sponsored by the Commander, Naval Air Systems Command, was held 14 through 16 October 1969 at the Charter House Hotel, Anaheim, California.

The purpose of these meetings is to enhance the professional knowledge of Aerospace Physiologists; to elaborate on concepts relating to physiological stresses and crew systems development; to discuss flight clothing, personal protective and survival equipment; and to discuss administration, management and future physiological training program development.

Guest speaker at the banquet held on 14 October 1969 was CDR Robert L. Schaub, USN, Head, Aviators Personal Equipment Branch, Staff, Commander Naval Air Force, U.S. Pacific Fleet. His topic was "The Role of the Aerospace Physiologist as a Member of the Aviators Personal Survival Equipment Team" (APSET). Attendees were given a special tour of the Lockheed Aircraft Corporation on 16 October 1969.

This year the Committee established for the first time and presented two awards. The award for Outstanding Naval Aerospace Physiologist went to LT W. W. McIntosh, MSC, USN, assigned to the Staff, Commander, Naval Air Systems Command. A Special Award in Naval Aerospace Physiology went to Chief Medical Service Warrant W. W. Frye, MSC, USN. Citations and award plaques were presented to the recipients.

JOINT COMMITTEE ON AVIATION PATHOLOGY APPOINTS NEW CHAIRMAN

The Joint Committee on Aviation Pathology held its Seventh Scientific Session at Royal Air Force, Halton, England, 13 through 15 October 1969, and at Royal Air Force Institute of Aviation Medicine, Farnborough, England on 16 October 1969.

CAPT B. H. Smith, MC, USN, Director, Armed Forces Institute of Pathology, served as chairman of one of the scientific sessions. Naval Flight Surgeons in attendance were CAPT F. H. Austin, Jr., MC, USN, Naval Safety Center, CAPT R. E. Luehrs, MC, USN, FMFPAC, and CAPT J. H. Britton, MC, USN, BUMED (Code 511). A paper on "A Jet Aircraft Involving Hypoxia" was given by CAPT Austin. CAPT Luehrs spoke on "A Flight Surgeon's View of Combat Injuries."

CAPT Austin was elected as the next Chairman of The Joint Committee on Aviation Pathology.

AVIATION PERSONAL AND SURVIVAL EQUIPMENT TEAM (APSET), "THE VOICE OF THE FLEET"

Those of you on our aerospace medical team who are supporting the operating forces in the field may not be familiar with the manner in which the procurement cycle operates to provide our aircrew personnel with the best personal and survival equipment on a reasonably standardized basis. This function, which is controlled from the headquarters level is a complex and costly operation that requires "cradle to grave" management within the current philosophy of the Department of Defense. The Department of Defense budget, particularly in the face of the Southeast Asia combat situation, demands this total systems' approach for obvious reasons. The procurement cycle begins with an analysis of the threat which is then projected into the foreseeable future, based upon the opposition's development capability. From this analysis a set of *Operational Requirements* is established. These requirements are stated in terms

of capabilities desired, or parameters to be met in countering the threat. Such documentation may range in scope from the requirement for a new nuclear attack carrier weapons system through an advanced fighter aircraft weapons system, to the next generation of aircrewman's protective clothing and personally-carried safety and survival equipment. The next step is to explore our resources to determine whether the *Requirement* can be met with an off-the-shelf item in our national inventory of materiel, or whether a research and development (R&D) effort is required. Relative priorities for procurement are then assigned, based upon ease of attainability. If the R&D community is to be tasked, a set of specifications for an item is then generated which translates the *Requirement Language* into the language of the technology that will be called on to produce an end-item of equipment. To make the best decisions in a highly austere budget environment, the Chief of Naval Operations and the Commandant of the Marine Corps are heavily dependent upon adequate communication with their operating forces afloat and in the field, who specify what their real needs are to fulfill their military mission.

In the aircrew Personal and Survival Equipment area the Chief of Naval Operations and Commandant of the Marine Corps depend upon APSET to fulfill this vital function. Dependent upon the recommendations of this team, decisions will then be made to provide direction to the Chief of Naval Material (CNM), who will eventually deliver the required end-item to the operating forces. CNM then tasks his various systems commands, according to his resources, and procurement begins from R&D through test and evaluation (T&E) to final delivery of inventory stocks for the fleet and field.

NEW DYNAMIC SPIN SIMULATION CAPABILITY OF THE HUMAN CENTRIFUGE AT THE NAVAL AIR DEVELOPMENT CENTER, JOHNSVILLE, WARMINSTER, PENNSYLVANIA

The continuing concern of the Navy for the safety of its pilots has prompted a search for a ground simulator capable of realistically reproducing aircraft spins. The operational necessity for flight close to stability limits increases the possibility of high-performance aircraft encountering spin; however, training and practice in spin in actual aircraft are prohibited because of the danger and cost. Therefore, an effective ground spin simulator would be an invaluable device for pilot training and proficiency.

APSET was created in 1964 and has met 15 times since its inception. The present chairman of the Team is Bureau of Medicine and Surgery (Code 52). A formal charter was granted in 1967 and was published as OPNAVINST 5420.59. Attention is invited to applicable portions of this Instruction for guidance of aerospace medical personnel, to insure that they are aware of the importance of communicating realistic needs to headquarters level through the fleet and field operational commanders' representatives. Flight Surgeons and other aerospace medical personnel should maintain close liaison with the squadron safety, survival and aircrew equipment personnel in order to assist their commands in full expression of operational needs.

RECOVERY OF PARACHUTISTS

Continuing studies of the physiologic responses of parachutists to recovery environment are being conducted at the Naval Aero Recovery Facility, El Centro, Calif. The purposes are twofold: 1) to define man's physiologic responses to aerospace recovery environment; and 2) to develop a tool to support the design, development and testing of future technologic advances in egress and recovery systems. Representatives from BUMED were given a demonstration of some test results during a recent field trip. LCDR D. H. Reid, MSC, an Aerospace Physiologist, is the officer in charge of the test studies. By means of instrumentation, biomedical and physical stress factors can be determined and related to all phases of test jumps. Actual work situations are duplicated as nearly as possible during the tests. It is hoped that meaningful data may be accumulated to assist design engineers in developing better egress and recovery systems.—AeroMed, BuMed.

With this in mind, the Aerospace Medical Research Department (AMRD) of the Naval Air Development Center (NADC) is conducting a study to determine whether a dynamic simulator such as the human centrifuge can be developed into a spin simulator. The centrifuge simulation is designed to contribute information about the necessary components of the simulator, the acceptability of the simulator to pilots, and the influence of visual presentation of the outside world on the simulation. The total task is

divided into two phases: Phase I, an open-loop program primarily to assess the centrifuge's ability to produce realistically the necessary forces in the proper environment, and Phase II, an assessment of the pilot's ability to reproduce the forces on the centrifuge using closed-loop control.

The dynamic flight simulator used is the AMRD 50-foot computer-controlled centrifuge. An actual F-4B cockpit has been mounted to fit within the 10-foot spherical gondola of the centrifuge and the original flight instruments have been adapted so that they can be driven by signals derived on an analog computer. All switches, levers, and other peripheral components of the cockpit have been retained to ensure a realistic environment for the pilot. The roll-and-yaw axes of the attitude director indicator have been driven by a combination of the sine and cosine of the involved angle to permit continuous rotation of the indicator in these axes.

Because control surfaces of the F-4B are power-actuated and do not give a natural aerodynamics feedback to the pilot, an artificial "feel" system has been designed into the aircraft controls to assist the pilot. The controls of the centrifuge cockpit have been given a similar feel.

Through appropriate programming, the centrifuge is capable of producing a force field similar to that created when an aircraft flies, goes into stall, post-stall gyration, spins, and pulls out of the spin in recovery.

A basic objective in any simulator is to "convince" the subjects that the "aircraft" is real. Data from actual spin test flights performed on an F-4B at the Naval Air Test Center (NATC) Patuxent River, Md., were used as the basis for the Phase I dynamic spin simulation. The spin of the F-4B was investigated from various spin entry conditions such as level-flight stalls, accelerated turns and reversals, and vertical and inverted climbs. The resultant spins were both to the right and to the left.

Special instrumentation on these flights enabled the analog signal recording of the multitude of aerodynamic parameters necessary to derive predetermined signals for both instrument and centrifuge command. Particular care was taken to obtain actual instrument reactions in preference to recording the actual aircraft conditions. The parameters which were taken and used in this simulation were: G_x , G_y , G_z (accelerations taken at the pilot's seat), p , q , r (body rates, angular velocities), α (angle of attack), IAS (indicated air speed), altitude, attitudes (angles of roll, pitch, and yaw), positions of the aileron-spoilers, stabilator and rudder, forces on the stick

and rudder pedals, and positions of stick and rudder.

In these flights a motion-picture camera was mounted over the right shoulder of the pilot, focused to record both the flight-instrument response and a view out of the window of the visual reference to the pilot. These films furnished the material for the development of a visual outside-world presentation to the centrifuge subjects.

Phase I. The subjects selected for the Phase I centrifuge simulation were eight Navy pilots from NADC and three test pilots from NATC who had flown actual spin flights in the F-4.

The experimental program consisted of having pilots experience and evaluate the simulated spins. Four representative spins were selected from the NATC data. In general, each pilot was scheduled to make four static and eight dynamic runs (four IFR and four VFR.) By reversing the direction of the pertinent signals, the possibility was created for any one spin to be either a left- or a right-turn spin.

The magnetic tape recordings of G_x , G_y , and G_z at the pilot's seat served as the drive signals for the analog computer. A coordinate conversion produced the arm drive for the centrifuge and also generated the gimbal drives to produce the desired total G force. Thus, the magnitude, direction, and frequency of the forces were well reproduced.

A projector was mounted inside the cockpit. The films were projected on a mirror situated behind and above the pilot and focused on a screen placed in front of the cockpit. The screen was outside the cockpit but within the gondola. The enlargement was of a size to compare with the field of view as seen by the original flight pilot.

The time relationship of the out-the-window display of the flight-control instruments and of the motion sensations was very critical.

Results. The experienced spin pilots affirmed the realism of the motions. It is interesting to note that most pilots not having had spin experience since training commented on the mildness of the forces over what they had anticipated. Pilots with F-4 spin experience who flew the IFR simulation commented that the forces seemed severe. Once the "fog" was replaced by visual display, the pilots were in agreement with the strength of the force field.

The violent three-directional oscillations that are present, especially in the incipient spin stage of the F-4B, are in themselves capable of producing vertigo, disorientation, and nausea. These effects are most pronounced in the absence of visual references. For example, one pilot had difficulty with vertigo in the "fog" condition but, with the visual display, expe-

rienced no vertigo. This observation correlates with reports of pilots' experiences in flight during cloud, fog, and other vision-limiting atmospheric conditions. Thus, because visual contact with the outside world is of vital importance to pilots, the visual reference on the simulator becomes essential.

The subject pilots were not given instructions concerning their use of the control mechanisms. Those pilots who were versed in high-performance aircraft recovery techniques responded by either voluntarily putting in proper signals or by requesting to do so. Pilots uncertain about recovery techniques either "wiped out" the cockpit or just gripped the stick and hung on. Thus the dynamic simulation was sufficiently realistic to excite a positive reaction in the evaluating subjects.

The close correspondence of the in-flight and simulator control positions lent credence to the realism of this simulation and supported the concept that training in a realistic simulator is beneficial.

Conclusions of Phase I. The open-loop simulation substantiated the concept of using the centrifuge as a dynamic simulator for aircraft spin maneuvers. The desirability and feasibility of a spin simulator which includes instrument activation, a dynamic force field, out-the-window visual display, and a realistic environment was clearly demonstrated.

The subject pilots, representing a wide scope of flying skills and backgrounds, found the centrifuge simulation realistic and those knowledgeable in spin recovery techniques were able to react with realistic control inputs. Pilots less familiar with high-performance jet spin recovery techniques did not respond as well.

Spins that included the dynamic motion and the visual display were judged to be the most realistic. Both motion and a realistic visual display have been shown to be essential for a successful spin simulation. Often the forces generated in spin differed from those anticipated by pilots who had not been in-

involved in an actual F-4 spin; nevertheless, the authenticity of the simulated spin was readily accepted.

Phase II. The first phase of this program was exploratory, primarily related to establishing the authenticity of the simulation in *open-loop mode*. In the current Phase II, or *closed-loop* phase, the subject will be able to control his force field, visual display, and simulated aircraft. Data collected will permit objective conclusions concerning pilot performance in flying his simulated aircraft in spin conditions.

The Dynamic Flight Simulator (DFS) is currently in the final countdown for the Phase II flights, expected to begin by 1 November 1969. When the capability of this centrifuge-computer complex in the realistic closed-loop simulation of aircraft forces in stable and unstable flight is successfully validated in this project, unlimited opportunities will arise for the evaluation of aircrew performance and physiological reactions to flight in a total aircraft environment. This expanded capability of the DFS will become even more effective with the recent establishment of a permanent DFS operating group, which will utilize and coordinate all the resources of the various AMRD divisions in conducting projects in this new dynamic simulation environment. Such resources include physiology, human factors, biochemistry, biophysics, vision, veterinary laboratories, and also major equipment items such as a vibration platform which can be operated either independently or on the DFS under varying force field conditions. The uprated simulator will also be an extremely useful T&E tool for evaluation of aircrew life support systems and equipment in the dynamic environment.

Thus, "come fly with us" carries exciting new meaning and potential these days of the Dynamic Flight Simulator at the Naval Air Development Center, Warminster, Johnsville, Pa.—AeroMed, BuMed.

NURSE CORPS SECTION

In response to a request for informal reports, the following items of interest were received.

PEOPLE-TO-PEOPLE PROGRAMS

LCDR Angelina T. Pommier, NC, USN directed a twelve-week course of instruction at the Naval Hospital in Guam, Mariana Islands, for Vietnamese enlisted men. The objective to train the Vietnamese

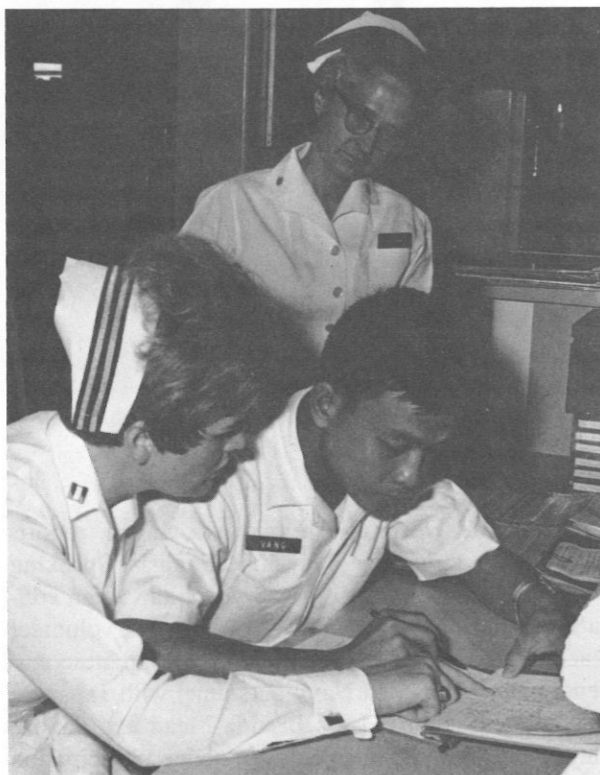
as hospital corpsmen despite a formidable language barrier, was met by employing the services of an interpreter and study guides based on San Diego Hospital Corps School lesson plans. The study



—Official U.S. Navy Photograph

guides were triple-spaced to allow room for Vietnamese translation, since the majority of students did not read or speak English. Classes and practical training were equally divided between recovery room and emergency procedures, medical ward and surgical ward routines. Available Navy training films were also used to supplement teaching and demonstrations. Vietnamese junior hospital corps personnel were schooled in current procedures and techniques in patient care, thereby enhancing their skill in performance of duty for their country.

Trust Territory beneficiary patients from South Pacific islands such as Yap, Truk and Ponape provide further challenge in overcoming the language barrier. The staff at Guam Naval Hospital has devised a vocabulary list for aiding communication. LTJG Diane Baily, NC, USNR, reports that a little ice cream goes a long way in facilitating communication on the pediatric service where most children rapidly acquire a functional vocabulary consisting of: "It hurts," "I'm hungry" and "ice cream." LCDR Doris Fuller, NC, USN, expressed a warm regard for these sturdy and pleasant people for whom the acquisition of their first pair of eye glasses at age 67 becomes a thrilling experience. Spectacles are



—Official U.S. Navy Photograph

apparently the current fad and designing an eye chart for refractions proved to be quite a project.

LCDR Mary Nester, NC, USN, reports that as many elements of Vietnamese culture as possible have been incorporated into hospital care of civilians at Station Hospital, Naval Support Activity, DaNang, R. V. N. Parents and siblings stayed with pediatric patients, grandparents were accompanied by grand-

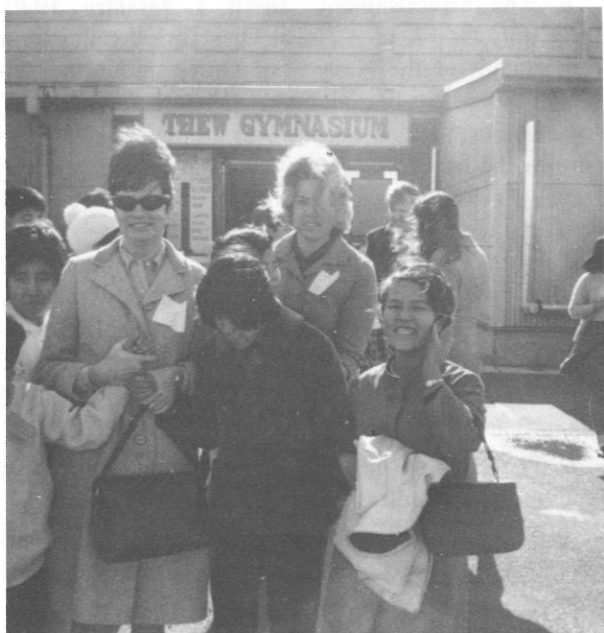
children who were aware of their special needs, and Vietnamese nursing assistants are being instructed and utilized in patient care. Although most of the staff Vietnamese do speak and understand a little English, an interpreter is used during teaching sessions in more complicated areas of nursing care. English classes for the Vietnamese and Vietnamese classes for Navy staff are being organized.



—Official U.S. Navy Photograph

U.S. Naval Hospital at Yokosuka, Japan, reports local interest in the Hayama English Speaking Society which originated 4 or 5 years ago as an educational and cultural society. In return for volunteer teaching of English by Americans, the Japanese students have acquainted Navy personnel with Japanese customs and culture. LT's Brenda Mead and Sandra Hayes, NC, USNR, have enjoyed active participation in the Society meetings. LT's Patricia McKenna, Kathryn Abbate, Mariann Stratton and Ida Marie

Cortez, NC, USNR, make weekly visits to Kita-Kamakura Orphanage. Despite rotation of working schedules, a group of three or four nurses consistently makes this trip each Sunday and obtains immense enjoyment from contact with these children who range from 2 to 16 years in age and reflect the typical good manners of the Japanese. Monthly birthday parties and day trips to Tokyo for the older children are prominent on the list of scheduled social events.



LT's Susan Murth and Peggy Self, NC, USNR, "Foster Parents" for a day, begin a holiday with orphanage children at the Naval Base in Yokosuka, Japan.

CDR Leah V. Osborne, Senior Nurse Corps Officer at Iwakuni Marine Corps Air Station Dispensary in Japan, wondered how to explain what is meant by a "People-to-People" program. She mentioned the Marines who were seen chopping scrap lumber to be used for heating water at a local orphanage, and nurses neatly stacking the pieces in a wood shed. Helping a group of Marines with a picnic for an orphanage was recalled, where shy, little, almond-eyed Japanese children devoured three hamburgers, four hot dogs, an enormous piece of cake and three cans of soda pop, apiece. (*It strikes us that having nurses along on such a picnic is not only nice, but practical too*). "Operation Happy Face," an annual fund drive to help support another orphanage, was said to have culminated in a memorable day of dinner, movies and presents for the children. Participation in an English conversation class with Japanese people who speak English was reported to provide mutual enjoyment and an opportunity to discuss current problems in both countries. Our correspondent hoped that these projects would qualify as "People-to-People programs," adding that she thought they did. (*CDR Osborne, we're with you!*)

EDITOR'S SECTION

ALL I WANT FOR CHRISTMAS-----

is to hear from you. Knowing how busy you can be, there is a natural reluctance to impose. Evidence of accomplishment and fine performance is far from lacking however, for I see and read about it in publications—other people's publications.

Often your professional papers are accepted for publication by the major league journals (the kind where you sign your life away), and that's very commendable. But some publishers deny the Newsletter reprint privileges, or charge a set fee per page for reprinting your work. The Newsletter is dependent upon those exceptions who generously grant reprinting authorization. Nobody can copyright your brain of course, your clinical material, compiled data, concepts, conclusions, experience and knowledge. With comparatively little additional effort, you could forward to the Newsletter a paper on the nitty-gritty of your topic, so long as it is not a word-for-word copy of a previously committed article (which may be cited as a reference). Massaging the same data several ways has become customary for

those with a long list of published papers to their credit.

If you're planning on writing a clinical or research paper of major proportions but have insufficient data or time for the moment, a preliminary report to the Newsletter should be considered. It might even lead to helpful collaboration. (Approximately 16,000 is a fairly impressive distribution.)

You may be assigned to duty which presents a unique opportunity for observation and treatment of a particular type of case. Although polished, retrospective and formal reports on those cases at some future date may be of value, if one ever gets to it, there is substantial merit to an on-the-spot, informal recording and documentation of your work. The Newsletter is especially geared to assist this type of effort and would welcome your contribution, informal though it may be.

There are many other opportunities to support the Newsletter. Is there a hospital, for example, which does not hold service meetings, CPC's, symposia or case presentations that are well done, at least occa-

sionally? A transcript of such proceedings could be of interest to Newsletter readers, and may well provide information superior to that found in second-rate papers which manage to get printed. Administrative problems which have been solved in some particular way, or even those which remain unresolved, could lead to interesting reading and communication. There is a constant demand for photographs in action which you alone can furnish. One picture can be worth 1,000 words.

Sometimes, I think, you don't realize how overall great you are.

Write.

Let me do my thing.

CHANGES IN THE NEWSLETTER

The spelling, for one thing.

The distribution is now SNDL (Standard Navy Distribution List). Active duty Navy personnel now receive their copy via the local command vice individual mailing from Philadelphia. Only inactive duty and retired Navy personnel, or other addressees, remain on the individual mailing list. Your attention is invited to the inside front cover for particulars. Distribution of publications universally presents problems these days. The Naval Publications and Forms Center in Philadelphia and the Newsletter will do everything possible to help, if there are problems. Your cooperation is also essential.

Your contributions are vital. The particulars printed on the inside back cover are in response to the frequent requests for same. They are based on the assumption that most facilities can provide the necessary services. If they cannot, submit material in whatever manner is possible. Your voice in the Newsletter should be heard, whatever the local capabilities may be.

More changes will be forthcoming. Any suggestions?

PROSPECTIVE REORGANIZATION OF THE NAVY'S DISABILITY SEPARATION SYSTEM

A Working Group (Project Streamline), composed of medical, legal, and personnel members attached to various Navy Department Bureaus and Offices, has conducted a review and comparative analysis of the Army, Navy, and Air Force disability separation systems and is developing the design of an administrative reorganization of the naval system. Certain organizational changes in the present structure of the naval system were proposed to SecNav.

The Secretary of the Navy has approved the

concept for the following organizational changes:

a. The establishment, about 1 January 1970, (*probably later*), of a Naval Disability Agency as a Department of the Navy Staff Office under the Assistant Secretary of the Navy (Manpower and Reserve Affairs). This agency will administratively supervise the naval physical evaluation boards and the Naval Physical Review Council; provide technical guidance to other interested activities; control, unify, and standardize the administration of the system and its case flow; set billet-assignment criteria within the system; and train its personnel and those of its subordinate activities.

b. The disestablishment of all existing physical evaluation boards.

c. The creation of a single, informal (*prima facie* type findings) Central Physical Evaluation Board.

d. The creation of several field formal (full and fair hearing type findings) physical evaluation boards.

e. The adoption of modified review procedures for the Naval Physical Review Council and the modification of the composition of its membership.

f. The development of a counseling system designed to assist disabled members whose cases are being processed.

g. The staffing of all billets (military and civilian) in the Agency, the Naval Physical Review Council, and the naval physical evaluation boards with primary-duty, trained personnel chosen to meet specific billet criteria.

h. The location of the maximum number of elements of the system, including at least the Agency, the Naval Physical Review Council, and the Central Physical Evaluation Board, in such proximity as to permit the expeditious processing of cases.

The new system is expected to provide better service to evaluatees; more accuracy and uniform interpretation of the law; better overall control; reduction in periods of hospitalization; fewer personnel required to run the system by a reduction in the number of Physical Evaluation Boards; and the new system will have more flexibility with the ability to absorb increased workload.

Final approval of the changes set forth above by SecNav, together with the required details thereof (including new and revised missions, functions, and organization of affected activities), will be published in a SecNav Instruction at a later date. In the meantime, all components of the current naval disability separation system will continue to function as usual. —BuMed, Code 33.

ACP CANDIDATE MEMBERSHIP

The American College of Physicians has expressed an interest in attracting young trainees in Internal Medicine who have completed at least 2 years of postdoctoral training in Internal Medicine. A new class in membership of the College, known as the Candidate Membership, has been created. The membership terminates automatically 1 year following the date on which the candidate becomes eligible for regular membership. Subscription to the Bulletin and Annals of Internal Medicine, as well as various notices of postgraduate and regional meetings are included in the modest Candidate Membership dues. Particulars can be found in the July 1969 issue of the ACP Bulletin and eligible medical officers are encouraged to participate.

BIOMEDICAL SCIENCES CORPS SYMPOSIA

The following symposia will be conducted by the Department of the Air Force during Fiscal Year 1970. Eligible Medical Corps, Dental Corps and Nurse Corps officers are those who meet the criteria prescribed by BUMED INSTRUCTION 1520.8 Series; Manual of the Medical Department 6-130; and BUMED INSTRUCTION 1520.14 Series, respectively. Eligible Medical Service Corps officers are those who are currently assigned to billets with a direct relationship to the courses listed and should apply in accordance with BUMED INSTRUCTION 1520.12 Series. Officers desiring to attend should submit their requests in time to reach the Bureau at least 6 weeks in advance of the convening dates of the symposia listed.

Symposium	Convening Date
Behavioral Sciences	
Symposium	19-21 January 1970
Pharmacy Symposium	6-8 April 1970
Bio-Environmental	
Engineering Symposium	14-16 April 1970

The above symposia will be conducted at the U.S. Air Force School of Aerospace Medicine, Brooks Air Force Base, Texas 78235. Officers selected for attendance should report to the School one day prior to convening date.

THE GARY P. WRATTEN SURGICAL SYMPOSIUM

The Gary P. Wratten Surgical Symposium entitled "Army Medical Department Officer Training Sched-

ule—Fiscal Year 1970," will be sponsored by Walter Reed General Hospital on Monday, Tuesday and Wednesday, April 6, 7 and 8, 1970. The Symposium is open to surgeons of the Army, Air Force, Navy, Veterans Administration, Public Health Service and civilians, particularly from the Reserve Corps and National Guard. Social events will include the wives. An outstanding program is being arranged and will include recent advances in the fields of general surgery and the surgical specialties, new advances in clinical research and new procedures and techniques. Civilian surgeons of national prominence are included on the program.

You are urged to make application for presentation of papers. Presentations will be limited to 15 minutes with few exceptions. Case reports will also be accepted, limited to 5 minutes. The title of your paper together with an abstract of not more than 50 words and the time required for presentation should be submitted no later than January 1, 1970. Abstracts should indicate author's rank, branch of service, unit and duty assignment. In the event of multiple authors, the presenter should be identified. Send your request for a space on the program to:

Colonel Charles W. Metz, Jr., MC, USA
Chief, Department of Surgery & Course Director
Walter Reed General Hospital
Walter Reed Army Medical Center
Washington, D. C. 20012

OSCAR B. HUNTER MEMORIAL AWARD

The American Therapeutic Society bestows The Oscar B. Hunter Memorial Award in recognition of an outstanding contribution or series of contributions to therapy by an individual or team of workers. The term "therapy" is used in a very broad sense to include the use of any drugs, procedures or device of benefit in the treatment of patients.

The Award consists of a bronze medal mounted on a plaque, struck in the likeness of Dr. Hunter and engraved with the name of the recipient and the date thereof. The winner will be expected to present a paper at the annual meeting of the Society which usually occurs on the week preceding the AMA meeting, covering the work forming the basis of the Award. Travel expenses to the meeting will be furnished. The Society hopes that this Award will serve as an increasing stimulus in the field of therapeutics and requests assistance in securing nominations of truly outstanding contributors to therapeutics.

The deadline for receiving nominations for the

1970 Award is February 28, 1970. Those interested in making nominations may send them to:

Harry E. Ungerleider, M.D.; Chairman
Committee on Scientific Awards
American Therapeutic Society
245 Park Avenue
New York, N.Y. 10017

The letter proposing a candidate for the Award should specify the reasons for the nomination, and should include the curriculum vitae of the candidate as well as a list of his publications.

This is an opportunity for all to honor deserving individuals, many of whom may not have received previous recognition for their work.

TWENTY-EIGHT NAVAL SURGEONS INDUCTED INTO A.C.S.

Twenty-eight Navy surgeons of commander rank—including two reservists—were inducted Friday, Oct 10, as new members (Fellows) of the American College of Surgeons (ACS) in cap-and-gown ceremonies during its annual 5-day clinical congress in San Francisco.

The Navy surgeons were among an anticipated 1,523 to be awarded the fellowship degree, the largest number scheduled for ACS induction in the organization's history.

The degree is awarded to those surgeons who fulfill comprehensive requirements of acceptable medical education and advanced training as specialists in a given branch of surgery, and who give evidence of good moral character and ethical practice.

The ACS, a voluntary scientific and educational association of surgeons, has 30,000 members in 92 countries. The College was founded in 1913 to improve care of surgical patients.

The Navy surgeons are Commanders Gaspar W.

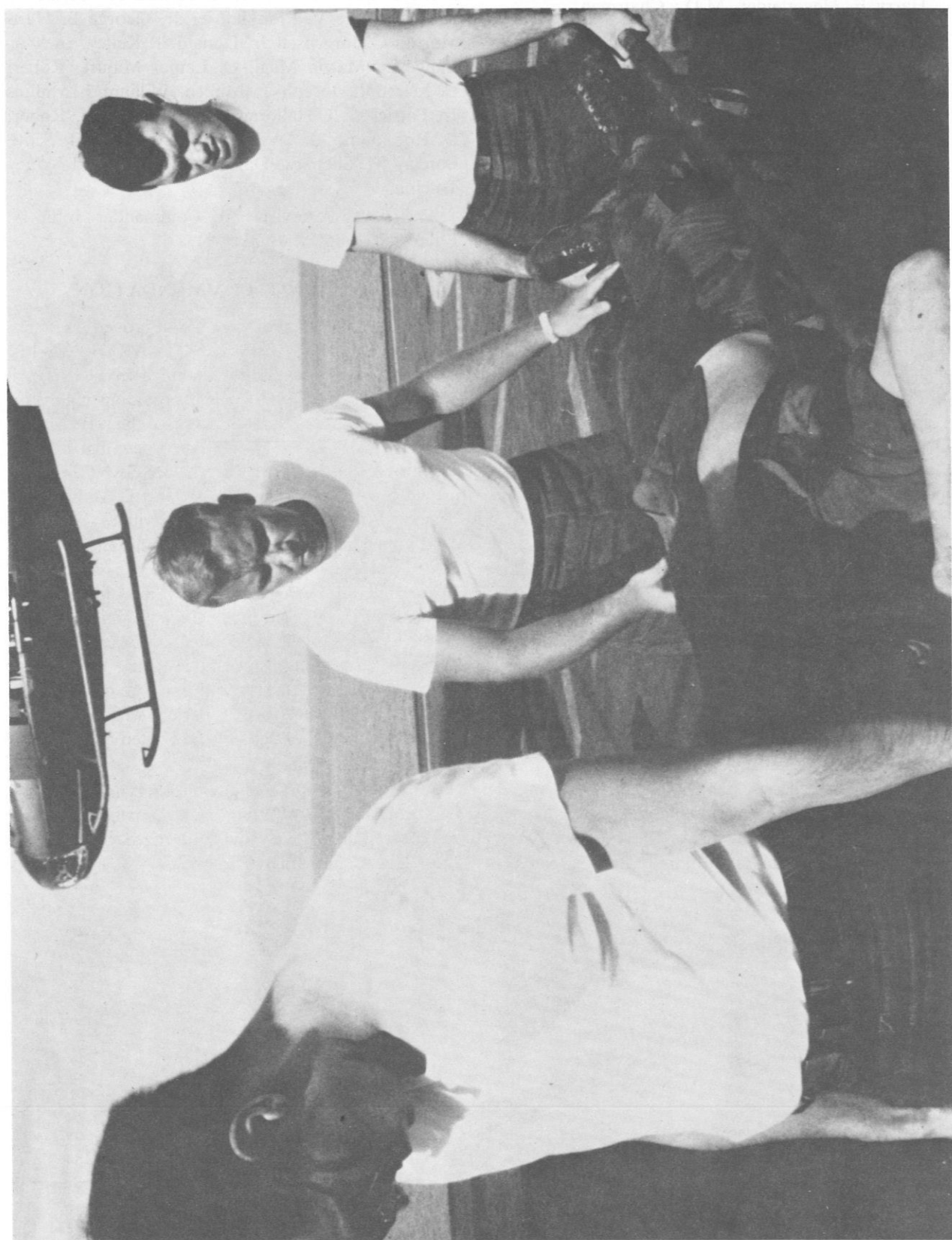
Anastasi, Martin G. Andersen, Claude C. Atkins, Frederick L. Austin Jr, Eugene F. Bartlett, Lawrence Brettschneider, Charles L. Brodhead Jr, Gerald L. Davis, George V. Frankhouser Jr, George B. Hart, Morton C. Jorgensen Jr, Donald L. Kelley, Jack A. Langevin, Martin Magi, O. Lamar Majure, Robert C. Meredith, Joseph T. Mullen, William J. Mullins Jr, Patrick S. O'Halloran, Berkley L. Rish, Robert D. Roe, James J. Ryskamp Jr, Augustus B. Scott, Barclay M. Shepard, David F. Thomas and Sidney Tolchin.

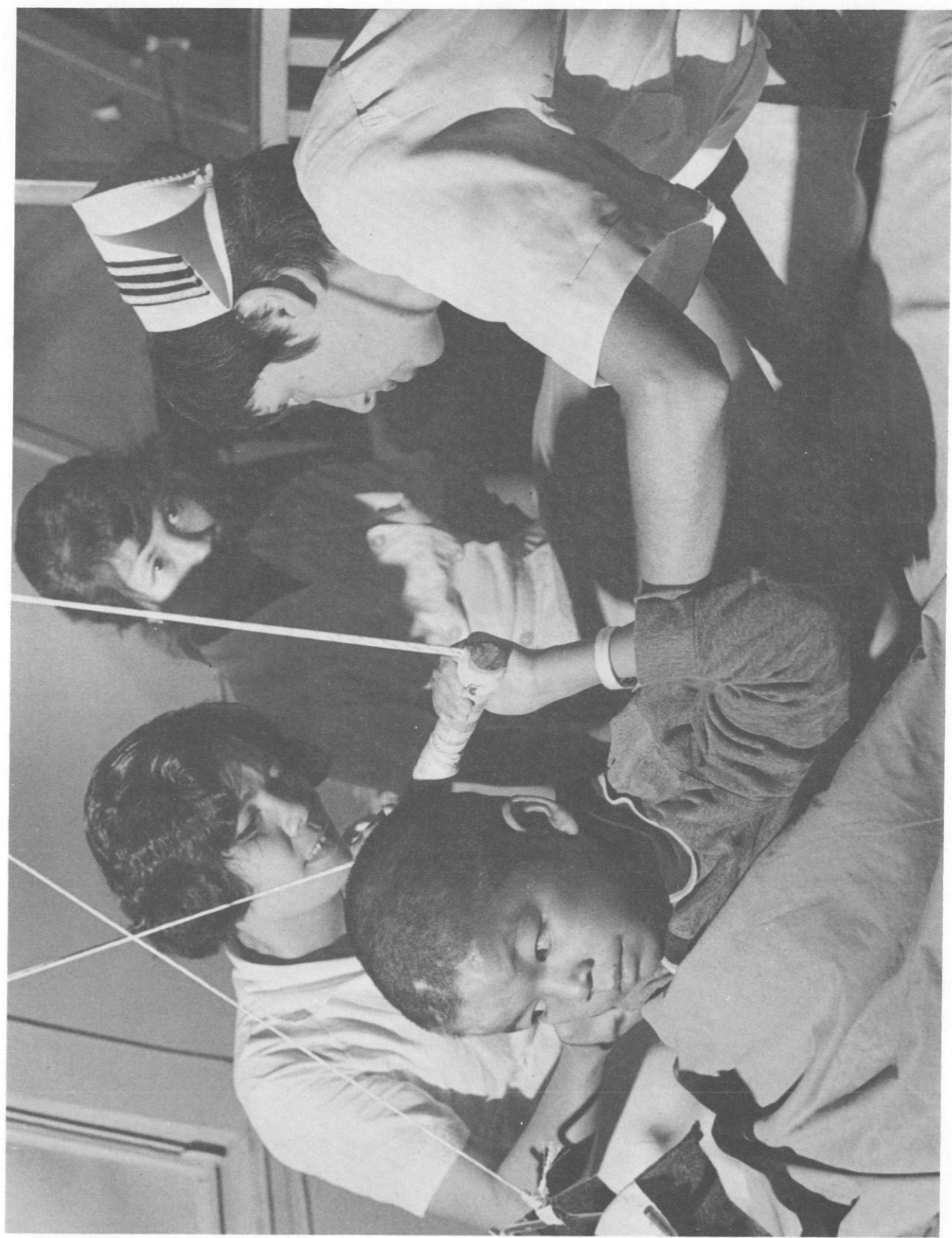
The naval reservists are Commander John A. Blum and John W. Bunke.

NAVY UNIT COMMENDATION

The Secretary of the Navy has approved a citation for commending the USS SANCTUARY (AH-17) for exceptionally meritorious service from 10 April 1967 to 10 April 1969 "while providing highly responsive Hospital-Ship services to the III Marine Amphibious Force." "In addition to combat medical support for United States Forces, USS SANCTUARY provided treatment for FREE-WORLD Military Assistance Forces and Vietnamese civilians in urgent need of medical service and humanitarian care. Her record of consistent meritorious service contributed in great measure to United States efforts in Southeast Asia where she was an invaluable sustaining element in the direct support of combatant forces. The resourceful professionalism and inspiring devotion to duty demonstrated by the officers and men of USS SANCTUARY during this period was in keeping with the highest traditions of the United States Naval Service."

All personnel attached to and serving on board USS SANCTUARY during the designated period, or any part thereof, are now authorized to wear the Navy Unit Commendation Ribbon.





United States Navy Medical Newsletter

CORRESPONDENCE AND CONTRIBUTIONS from the field are welcomed and will be published as space permits, subject to editing and possible abridgment. All material should be submitted to the Editor, Navy Medical Newsletter, Code 38, Bureau of Medicine and Surgery, Washington, D.C. 20390.

NOTICES should be received not later than the third day of the month preceding the month of publication.

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SUGGESTIONS are invited concerning the Newsletter, its content and form. Comments should be forwarded to the Editor.

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